Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
GARMIN INTERNATIONAL, INC.	)	WT Docket No. 01-339
	)	
Amendment of Sections 95.193(a) and 95.631(d) to Authorize Manufacture, Sale and Use of GPS Transmission Enhanced Family Radio Service Units	)	RM - 10070
	)	
Amendment of Sections 95.193(a), 95.193(b), and 95.631(d) of the Commission's Rules Governing Permissible Communications in the Family Radio Service	)	

COMMENTS OF XM RADIO INC.

XM Radio Inc. ("XM"), a satellite Digital Audio Radio Service ("SDARS") licensee, hereby files these Comments in the above-captioned proceeding in which the Commission is proposing to amend its rules to allow family radios to transmit digital data. While XM does not object to the Commission's proposals, it is concerned about the fifth harmonic emissions of family radios operating on Channels 8-14 at 467 MHz interfering with XM's SDARS operations at 2332.3-2345 MHz. XM urges the Commission to limit the out-of-band emissions from these family radios in the 2332.5-2345 MHz band to a field strength level of no more than 8.6 μV/m at 3 meters measured in a 1 MHz interval.

Background

The Development of SDARS in the S-band. In 1995, the Commission allocated spectrum in the S-band to the satellite Digital Audio Radio Service ("SDARS"). XM and Sirius Satellite Radio Inc. ("Sirius") were the winning bidders in the SDARS auction held in April

1997, together committing nearly $170 million to the U.S. Treasury.[1] XM was awarded the license to provide SDARS in the 2332.5-2345 MHz band. As the Commission has repeatedly recognized, this new consumer-based mass media service promises enormous public interest benefits for the U.S. public.[2]

Since its licensing, XM and Sirius have made extraordinary progress in the development of their SDARS systems. Both licensees are now fully funded through their scheduled initiation of commercial service, having raised billions of dollars in the process. Both XM and Sirius have successfully launched their satellites. In September 2001, XM initiated commercial service, providing high-quality, continuous, nationwide multichannel audio service. In its first four months of service, XM has proven to be a tremendous success. XM has won numerous awards, including Fortune Magazine's Product of the Year,[3] and achieved 30,000 subscribers in its first eight weeks of service, making it the fastest selling audio product of the last twenty years.

SDARS is bringing about the consumer benefits the Commission hoped it would when it issued licenses in 1997. The availability of SDARS is increasing the variety of programming available to the listening public, offering an unprecedented variety of music and information, including in areas of the country that have traditionally been underserved by terrestrial radio

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1 American Mobile Radio Corporation, 13 FCC Rcd 8829 (Int'l Bur., 1997); Satellite CD Radio, 13 FCC Rcd 7971 (Int'l Bur., 1997).

2 *See, e.g.*, Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Report and Order, Memorandum Opinion and Order*, 12 FCC Rcd 5754, ¶ 1 (1997) ("*SDARS Order*").

3 Peter Lewis, *My Favorite Things*, Fortune Magazine, Dec. 24, 2001, at 169 (naming XM Satellite Radio "Product of the Year" and stating "[o]f all the new technologies of 2001, XM Satellite Radio is way, way, way above the rest. It's the first major advance in radio since FM emerged in the1960s, and the best thing to happen to mobile music since the dashboard CD player.").

stations.[4] Not only are consumers enjoying increased diversity in audio programming, they are experiencing high-quality, digital sound not offered by terrestrial radio stations.

On December 20, 2001, the Commission released the above-captioned NPRM proposing to amend its rules to allow family radios to transmit digital data, specifically Global Positioning System ("GPS") location information in a digital data burst.[5] Family radios have become an extremely popular means to communicate over short distances.[6] Family radios are authorized to operate on certain frequencies at 462 MHz (Channel 1-7) and 467 MHz (Channels 8-14). 47 C.F.R. § 95.627. The transmitted fifth harmonic of family radios operating on Channels 8-14 fall within XM's licensed frequency band of 2332.5 – 2345 MHz. Family radios are required to attenuate power by at least 43 + 10 log (T) dB, where T is transmitter power, on any frequency removed from the center of the authorized bandwidth by more than 250%. 47 C.F.R. § 95.935(b)(7).

Discussion

I. THE COMMISSION'S RULES PROVIDE THAT FAMILY RADIOS WILL BE REQUIRED TO PREVENT HARMONIC EMISSIONS FROM INTERFERING WITH LICENSED SERVICES

The Commission has a fundamental obligation to protect licensed services such as SDARS from interference by harmonic emissions from family radios. The Commission's rules regarding the family radio service provide family radios operators and manufacturers with notice

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4 *SDARS Order* at ¶ 1.

5 Garmin International, Inc., *Notice of Proposed Rulemaking*, WT Docket No. 01-339 (Dec. 20, 2001).

6 Leonard Wiener, "Hello? Can you hear me? Walkie-talkies are the rage," U.S. News and World Report, p. 57 (July 2, 2001) (stating that 1.1 million family radios were sold in the first four months of 2001); Gary Shapiro, "Furnishing the Ultimate Living Room and Beyond," Appliance, p. 65 (January 1, 2001) (noting that sales of family radios will continue to grow in 2001).

that the Commission may require technical changes to equipment to solve interference problems caused by harmonic emissions.[7]

II. THE OUT-OF-BAND EMISSIONS LIMITS CURRENTLY APPLICABLE TO FAMILY RADIOS ARE NOT ADEQUATE TO PROTECT SDARS RECEIVERS

XM does not object to the Commission's proposals in the above-captioned NPRM and does not dispute that allowing family radios to transmit GPS location information will be useful to the public. XM is concerned, however, that the present out-of-band emissions limits for family radios operating on Channels 8-14 at 467 MHz are not adequate to protect XM's SDARS receivers. XM is concerned that future proliferation of family radios at present out-of-band emissions limits will adversely affect the high-quality service SDARS consumers expect.

III. THE COMMISSION SHOULD PROMPTLY UPDATE THE OUT-OF-BAND EMISSIONS LIMITS FOR FAMILY RADIOS TO PROTECT XM'S SDARS OPERATIONS

On October 15, 2001, the Commission released an NPRM seeking to review its Part 15 and Part 18 rules regarding, among other things, emissions from unlicensed devices operating above 2 GHz.[8] The Commission stated that a review was needed to ensure "continued growth in the area of unlicensed devices while protecting against harmful interference to authorized services." *Part 15 NPRM* at ¶ 2. On February 12, 2002, XM filed Comments in that proceeding asking the Commission to update its rules to limit out-of-band emissions from unlicensed

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[7] 47 C.F.R. § 95.635 Note 4 ("If spurious or harmonic emissions result in harmful interference (any transmission, radiation or induction that endangers the functioning of a radionavigation or other safety service or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with applicable laws, treaties and regulations), the FCC may, at its discretion, require appropriate technical changes in the station equipment to alleviate the interference, including the use of a low pass filter between the transmitter antenna terminals and the antenna feed line.").

devices into the 2320-2345 MHz band to a field strength level of no more than 18 μV/m at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside of vehicles and 8.6 μV/m at 3 meters measured in a 1 MHz interval for unlicensed devices in all other environments.[9] In these Comments, XM explained that the transmitted fifth harmonic of family radios operating on Channels 8-14 falls within XM's licensed frequency band of 2332.5 – 2345 MHz. XM Comments at 10-11, 18-20. Accordingly, XM urged the Commission to apply these emissions limits to family radios operating pursuant to Part 95 of the Commission's rules on Channels 8-14 at 467 MHz. *Id.* at 18-20. XM hereby incorporates those comments into this proceeding and asks the Commission to limit the out-of-band emissions of family radios into 2332.5-2345 MHz band accordingly.

Footnote continued from previous page

[8] Review of Part 15 and other Parts of the Commission's Rules, *Notice of Proposed Rulemaking and Order*, ET Docket No. 01-278 (Oct. 15, 2001) ("*Part 15 NPRM*").

[9] *See* Comments of XM Radio Inc., ET Docket No. 01-278 (February 12, 2002) ("XM Comments") (attached hereto).

Conclusion

Based on the foregoing, XM urges the Commission to act consistently with the views expressed herein.

Respectfully submitted,

XM RADIO INC.

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February 13, 2002

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
Review of Part 15 and other Parts of the	)	ET Docket No. 01-278
Commission's Rules	)	RM-9375
	)	RM-10051

COMMENTS OF XM RADIO INC.

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February 12, 2002

Summary

In September 2001, XM Radio Inc. ("XM") initiated its satellite Digital Audio Radio Service ("SDARS"), providing high-quality, continuous, nationwide multichannel digital audio service. In its first four months of service, XM has proven to be a tremendous success. XM has won numerous awards, including Fortune Magazine's Product of the Year, and achieved 30,000 subscribers in its first eight weeks of service, making it the fastest selling audio product of the last twenty years. SDARS is truly bringing about the consumer benefits the Commission hoped it would when it issued SDARS licenses to XM and Sirius Satellite Radio Inc. ("Sirius") in 1997.

XM is concerned with the proliferation of unlicensed devices operating in the 2.4 GHz band and family radios operating on Channels 8-14 at 467 MHz pursuant to current Commission out-of-band emissions limits. These devices include communications devices such as cordless phones and new "Bluetooth," IEEE 802.11, and HomeRF devices that enable wireless internet access and short-range communications between computing and telecommunications devices like laptop computers, cellular phones, Palm Pilots, wireless headphones, and other equipment. These devices also include Industrial, Scientific, and Medical ("ISM") devices, such as microwave ovens and RF lights.

XM urges the Commission to update the limits on out-of-band emissions by unlicensed devices to protect SDARS consumers. In the next few years there will be millions of SDARS receivers operating in close proximity to millions of unlicensed devices, many of which operate in the same frequency range. Prompt action by the Commission thus represents prudent spectrum management. The present out-of-band emissions limits applicable to these Part 15 and Part 18 devices were adopted at a time when there were no consumer-oriented mass media services operating above 1000 MHz and relatively few unlicensed devices operating at 2.4 GHz.

XM is not proposing that any existing unlicensed devices be required to cease operation and the updated limits proposed herein will not be expensive for manufacturers of unlicensed devices to meet. A recent study shows that the SDARS frequencies at present are free of virtually any noise. It is critical to SDARS consumers that the Commission preserve that situation.

Specifically, XM urges the Commission to establish, effective 18 months after adoption, an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 μV/m at 3 meters measured in a 2 MHz interval for all unlicensed devices operating exclusively inside of vehicles and 8.6 μV/m at 3 meters measured in a 1 MHz interval for unlicensed devices operating in all other environments. XM urges the Commission to apply these emissions limits to the following unlicensed devices: (i) spread spectrum and other unlicensed devices operating pursuant to Part 15 of the Commission's rules; (ii) ISM devices operating in the 2400-2483.5 MHz band pursuant to Part 18 of the Commission's rules; and (iii) family radios operating pursuant to Part 95 of the Commission's rules on Channels 8-14 at 467 MHz.

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Commission's Rules	)	RM-9375
	)	RM-10051

COMMENTS OF XM RADIO INC.

XM Radio Inc. ("XM") hereby files these comments urging the Commission to adopt rules to protect consumer receivers of satellite Digital Audio Radio Service ("SDARS") at 2.3 GHz from interference from out-of-band emissions from unlicensed devices operating pursuant to Part 15, Part 18, and Part 95 of the Commission's rules. To protect SDARS receivers, the Commission should update its rules to establish an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 μV/m at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside of vehicles and 8.6 μV/m at 3 meters measured in a 1 MHz interval for unlicensed devices in all other environments.[1] XM urges the Commission to apply these emission limits to the following unlicensed devices: (i) spread spectrum and other unlicensed devices pursuant to Part 15 of the Commission's rules; (ii) industrial, scientific, and medical ("ISM") devices operating in the 2400 – 2483.5 MHz ("2.4 GHz") band pursuant to Part 18 of the Commission's rules; and (iii) family radios operating

[1] Sirius Satellite Radio Inc. ("Sirius"), the other SDARS licensee, recently filed a Petition for Rulemaking proposing these same emissions limits for Part 15 and Part 18 unlicensed devices. *See* Sirius Satellite Radio Inc., Petition for Rulemaking (Jan. 23, 2002). XM supports Sirius's Petition and urges the Commission to consider Sirius's Petition in the context of the above-captioned proceeding. XM notes that its concerns with out-of-band emissions from unlicensed devices also extends to family radios operating on channels 8-

Footnote continued on next page

pursuant to Part 95 of the Commission's rules on Channels 8-14 at 467 MHz. By acting expeditiously, the Commission can prevent the development of a major interference problem, potentially affecting tens of millions of consumers, and do so without imposing any significant costs on industry or the public.

Background

The Development of SDARS in the S-band. In 1995, the Commission allocated spectrum in the S-band to the satellite Digital Audio Radio Service. XM and Sirius Satellite Radio Inc. ("Sirius") were the winning bidders in the SDARS auction held in April 1997, together committing nearly $170 million to the U.S. Treasury.[2] XM was awarded the license to provide SDARS in the 2332.5 – 2345 MHz band. As the Commission has repeatedly recognized, this new consumer-based mass media service promises enormous public interest benefits for the U.S. public.[3]

Since its licensing, XM and Sirius have made extraordinary progress in the development of their SDARS systems. Both licensees are now fully funded through their scheduled initiation of commercial service, having raised billions of dollars in the process. Both XM and Sirius have successfully launched their satellites. In September 2001, XM initiated commercial service, providing high-quality, continuous, nationwide multichannel audio service. XM in its first three months of service has proven to be a great success. One need only look at the 30,000 customers

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14 at 467 MHz, whose transmitted fifth harmonic falls within XM's, but not Sirius's, licensed frequency band.

2 American Mobile Radio Corporation, 13 FCC Rcd 8829 (Int'l Bur., 1997); Satellite CD Radio, 13 FCC Rcd 7971 (Int'l Bur., 1997).

3 *See, e.g.*, Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Report and Order, Memorandum Opinion and Order*, 12 FCC Rcd 5754, ¶ 1 (1997) ("*SDARS Order*").

XM has acquired in its first eight weeks of service and the numerous awards XM has already won, including Fortune Magazine's Product of the Year,[4] to realize that SDARS is bringing about the consumer benefits the Commission hoped it would. The availability of SDARS is increasing the variety of programming available to the listening public, offering an unprecedented variety of music and information, including in areas of the country that have traditionally been underserved by terrestrial radio stations.[5] As discussed below, however, XM is concerned with the expected proliferation of unlicensed devices operating pursuant to current Commission out-of-band emissions limits and the interference they may cause to SDARS receivers.

SDARS subscribers are investing in the service by purchasing and installing SDARS radios. Reception of SDARS depends on the transmission of a signal from a satellite to a very small antenna. SDARS receivers are expected to be used predominantly in mobile environments, but SDARS is also expected to be popular in homes and other fixed locations. While XM's satellites are state-of-the-art and among the most powerful communications satellites ever manufactured, the downlink signal power available to the receiver is much lower than terrestrial-based communications systems, thereby requiring very sensitive SDARS receivers. The sensitivity of SDARS reception to interference in the car environment is described in further detail in Exhibit A. Moreover, due to the nature of the service, a digital audio broadcast system requires a service availability of over 99%. The loss of an adequate

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4 Peter Lewis, *My Favorite Things*, Fortune Magazine, Dec. 24 2001, at 169 (naming XM Satellite Radio "Product of the Year" and stating "[o]f all the new technologies of 2001, XM Satellite Radio is way, way, way above the rest. It's the first major advance in radio since FM emerged in the1960s, and the best thing to happen to mobile music since the dashboard CD player.").

5 *SDARS Order* at ¶ 1.

signal will produce a total loss of audio. Therefore, the availability requirements for an SDARS system are much more stringent than that of mobile telephony systems. People using mobile phones have accepted the fact that intermittent outages or bursts of noise occur during the course of a conversation. Intermittent outages or bursts of noise will not be tolerated by an SDARS subscriber who is paying for uninterrupted, high-quality digital radio.

XM provides service to its subscribers directly through its licensed SDARS satellites in over 99% of its coverage area. Terrestrial repeaters are used only to provide service in urban areas and elsewhere where it may be difficult to receive satellite-based signals due to line-of-sight blockage from foliage, buildings, and other obstacles. Even within the coverage area of the terrestrial repeater, there will be areas where the amplitude of the terrestrial signal is close to the receiver threshold.

The Commission has made clear that SDARS subscribers can expect to receive high-quality service without the threat of unreasonable interference. The Commission has stated that that "[i]n authorizing DARS, it was our desire to ensure a high quality radio service."[6] The Commission further stated that:

> We [recognize] that the 2320-2345 MHz frequency band is the only spectrum specifically available for provision of Satellite DARS in the United States. Accordingly, if Satellite DARS in this spectrum is subject to excessive interference, the service will not be successful and the American public will not benefit from the service. *WCS Order* at ¶ 27.

Proliferation of Unlicensed Devices. XM has identified three types of unlicensed devices that are presently allowed to transmit out-of-band emissions at levels that have the potential to interfere with reception of SDARS satellite signals: (i) spread spectrum and other radio

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[6] Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service ("WCS"), *Memorandum Opinion and Order*, 12 FCC Rcd 3977, ¶ 25 (1997) ("*WCS Order*").

frequency devices operating in the 2.4 GHz band and other unlicensed devices operating pursuant to Part 15 of the Commission's rules; (ii) industrial, scientific, and medical ("ISM") devices operating in the 2.4 GHz band pursuant to Part 18 of the Commission's rules; and (iii) family radios operating on an unlicensed basis on Channels 8-14 at 467 MHz pursuant to Part 95 of the Commission's rules, whose transmitted fifth harmonic could cause interference to XM's SDARS receivers.

Unlicensed Part 15 Devices. In general, Part 15 of the Commission's rules governs unlicensed radio frequency ("RF") devices. Examples of such devices includes garage door openers, remote controls, and cordless phones.[7] One of the bands available for the operation of Part 15 RF devices is the 2400-2483 MHz ISM band, just 55 MHz from the edge of XM's licensed frequency band.

As a result of developments in digital technology, applications such as unlicensed wireless internet access and short-range communications between computing and telecommunications devices like laptop computers, cellular phones, PDAs, wireless headphones, and other equipment have started to become and will become increasingly common operating in the 2.4 GHz band in the same environment as SDARS receivers. A joint venture of a number of companies, including Microsoft, Nokia, Motorola, IBM, Ericsson, and Intel, has proposed the "Bluetooth" standard, which is intended to enable users to wirelessly interconnect PDAs, cell phones, cameras, computers, and other mobile devices. The Bluetooth project is an example of an effort to develop wire replacement, spread spectrum devices which operate in the 2.4 GHz

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[7] The Commission is also currently considering authorizing ultra-wideband ("UWB") devices under Part 15. *See* Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, *Notice of Proposed Rulemaking*, ET Docket 98-153 (May 11, 2000) ("*UWB NPRM*").

band.[8] One expected application for Bluetooth devices is to enable hands-free use of mobile phones in vehicles.[9] While projections regarding the specific rate and scope of Bluetooth deployment vary, one research group recently predicted that there will be 1.4 billion Bluetooth-enabled devices in the market in 2005.[10] In addition, Bluetooth transmitters over time will be used for an increasing variety of functions. Printers, fax machines, Wireless LANs, and other equipment will be able to communicate with each other, and most cellular phones, two-way pagers, wireless data-only terminals, and most other two-way, wireless-capable devices will be Bluetooth-equipped.[11]

Current Out-of-Band Emissions Limit Applicable to Part 15 Devices. In 1989, the Commission established a general framework for emissions limits for all unlicensed Part 15 intentional radiators, now contained in Section 15.209.[12] In that order, the Commission applied

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8 Spread spectrum devices spread the emitted energy over a wide bandwidth, using either a method of direct sequencing, frequency hopping, time hopping, pulsed FM, and hybrid systems, which makes the emission more resistant to interference from other sources. Authorization of Spread Spectrum and Other Wideband Emissions Not Presently Provided for in the FCC Rules and Regulations, *First Report and Order*, 1985 FCC LEXIS 4159, ¶ 1 n.1 (1985) ("*Spread Spectrum Order*").

9 *See* Press Release, "Bluetooth Wireless Technology in Automotive Applications," (Oct. 16, 2001) (available at http://www.bluetooth.com/news/).

10 *See* "Bluetooth Emergence Explained at ABI Conference," PR Newswire (April 11, 2001) (citing report of Allied Business Intelligence); *see also* Melanie Reynolds, "Bluetooth Boomtime Over Next Five Years, Say Reports," Electronics Weekly, July 18, 2001, at p. 3 (citing a Micrologic Research report that there will be a huge increase in demand for Bluetooth chipsets, with sales going from 0.4 million units in 2000 to1.156 billion units in 2005).

11 *Bluetooth Technology: Look, Ma! No Cable*, Computers Today, February 15, 2000, at p.56.

12 After decades of regulating unlicensed radiators on a patchwork basis and applying different emissions limits to specific devices and frequency bands, the Commission's 1989 Order overhauled Part 15. *See* Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License, *First Report and Order*, 4 FCC Rcd 3493, ¶ 5 (1989) ("*1989 Part 15 Order*"). In this new general framework, the Commission divided the RF spectrum into segments and established different emissions limits for intentional radiators operating in each of these spectrum bands. *Id.* at ¶¶ 20-29.

an emissions limit of 500 μV/m at 3 meters to unlicensed intentional radiators operating above 960 MHz.[13] Thus, under the Commission's current rules, 2.4 GHz devices are not permitted to emit a signal with a field strength exceeding 500 μV/m at 3 meters into the "restricted" band at 2310-2390 MHz, which includes the S-band SDARS allocation. 47 C.F.R. §§ 15.209, 15.247.[14] As discussed in Exhibit A, this limit is not adequate to protect SDARS receivers. To the extent that these Part 15 devices operate in close physical proximity to SDARS receivers, they have the potential to cause interference to reception of SDARS.

As discussed further in Exhibit A, the Bluetooth technical specification is designed to permit out-of-band emissions at the current Part 15 level. XM's discussions with the Automotive Multimedia Interface Collaboration (AMIC) have indicated that Bluetooth and other unlicensed RF devices to be employed in automobiles will be required to meet an out-of-band emissions limit of 18 μV/m at 3 meters into the SDARS band.

In addition to the Bluetooth technology, communications companies are designing systems using alternative technologies to operate in the 2.4 GHz band. This includes systems like the IEEE 802.11b (WiFi) and HomeRF.[15] These systems are designed to operate in a spread spectrum mode like the Bluetooth system, but are not expected to be deployed, as Bluetooth will be, in the automotive environment. These systems will be found extensively in the workplace

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13 The Commission initially deferred application of its general Section 15.209 limits to spread spectrum devices. These limits were formally applied to out-of-band emissions from spread spectrum devices one year later. Amendment of Parts 2 and 15 of the Rules With Regard to the Operation of Spread Spectrum Systems, *Report and Order*, 5 FCC Rcd 4123, ¶¶ 28-29 (1990).

14 Similarly, the field strength of radiated emissions above 960 MHz from unintentional radiators may not exceed 500 μV/m at 3 meters, except for Class A digital devices which are restricted to 300 μV/m at 3 meters. 47 C.F.R. § 15.109(a), (b).

15 "*Wireless LANs Explode with a Kaleidoscope of Options,*" Electronic Design, No. 11, Vol.48, May 29, 2000, at p.71.

and home, however, and the potential interference from such operations is another area of concern for SDARS, if their out-of-band emissions are as high as Part 15 rules currently permit.

In May 2001, the Commission initiated a Further Notice of Proposed Rulemaking ("FNPRM") proceeding to amend Part 15 of its rules to facilitate the development and deployment of new unlicensed wireless devices operating in the 2.4 GHz band.[16] The Commission sought comment on proposed amendments to its rules designed to improve spectrum sharing by unlicensed devices in the 2.4 GHz band, provide for introduction of new digital transmission technologies, and eliminate certain regulations for spread spectrum systems. *Spread Spectrum FNPRM* at ¶ 1. Both XM and Sirius filed comments in this proceeding noting their concern that the current out-of-band emissions limits applicable to Part 15 devices operating in the 2.4 GHz band does not adequately protect SDARS receivers and that the proliferation of unlicensed Part 15 devices in the 2.4 GHz band threatens the performance of SDARS.[17]

ISM Devices Operating Pursuant to Part 18 in the 2.4 GHz ISM Band. ISM equipment, such as microwave ovens, industrial heating equipment, welding equipment, and RF lighting devices use RF energy to perform a function other than communications. These devices emit RF energy into the ether as a result of their use of such energy. One of the bands available for the operation of ISM devices is the 2.4 GHz band.

Current Out-of-Band Emissions Limits Applicable to Part 18 ISM Devices Operating in the 2.4 GHz Band. Section 18.305(b) Commission's rules establishes differing out-of-band

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16 Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices, *Further Notice of Proposed Rulemaking and Order*, ET Docket No. 99-231 (May 11, 2001) ("*Spread Spectrum FNPRM*").

17 Comments of Sirius, ET Docket No. 99-231 (August 27, 2001); Reply Comments of XM, ET Docket No. 99-231 (September 25, 2001).

emissions levels for varying types of ISM devices. 47 C.F.R. § 18.305(b). For example, the current out-of-band emissions limit for "miscellaneous" ISM devices generating an RF power greater than 500 watts is 25 * square root of (power/500 watts) at 300 meters, which is equivalent to approximately 3500 μV/m at 3 meters for a 1000 watt device. To the extent that Part 18 ISM devices operate in close proximity to SDARS receivers at present out-of-band emissions levels, they have the potential to cause interference to reception of SDARS.

The Commission is presently considering the appropriate out-of-band emissions limit for one type of ISM device, RF lighting devices, that will operate in the 2.4 GHz ISM band.[18] While Section 18.305(c) of the Commission's rules establishes out-of-band emissions limits for RF lighting devices operating below 1000 MHz, there are no out-of-band emissions limits specifically applicable to RF lighting devices operating in the 2.4 GHz band. Thus, these lighting devices are allowed to operate pursuant to the out-of-band limit of 25 * square root of (power/500 watts) at 300 meters for "miscellaneous" ISM devices. In its NPRM on RF lighting devices operating in the 2.4 GHz band, the Commission stated "[w]e are particularly concerned that this [out-of-band] energy could cause interference to other services operating near the 2450 MHz band, such as the Digital Audio Radio Service operating in the 2320-2345 MHz frequency band."[19] To address this concern, the Commission proposed an emissions limit of 500 μV/m at 3 meters for consumer RF lighting equipment and an emission limit of 100 μV/m for non-consumer RF lighting equipment. XM and Sirius have actively participated in this proceeding, establishing that the Commission's proposed emissions limit for 2.4 GHz RF lighting devices is

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18 Amendment of Part 18 of the Commission's Rules to Update Regulations for RF Lighting Devices, *Notice of Proposed Rulemaking*, 13 FCC Rcd 11307 (1998) ("*RF Lighting NPRM*").

19 *Id.* at ¶ 12 (1998).

not sufficient to protect SDARS receivers and that Commission should instead adopt an emissions limit of 8.6 μV/m at 3 meters for these lights. This proceeding is still pending.

Family Radios. In 1996, the Commission established the Family Radio Service designed to provide a very short distance, unlicensed, two-way voice personal radio service.[20] Family radios have become an extremely popular means to communicate over short distances.[21] In December 2001, the Commission proposed to amend the FRS rules to allow family radios to transmit data.[22]

Family radios are authorized to operate on certain frequencies at 462 MHz (Channel 1-7) and 467 MHz (Channels 8-14). 47 C.F.R. § 95.627. The transmitted fifth harmonic of family radios operating on Channels 8-14 falls within XM's licensed frequency band of 2332.5 – 2345 MHz.

Current Out-of-Band Emissions Limits Applicable to Part 95 Family Radios. Family radios are required to attenuate power by at least 43 + 10 log (T) dB, where T is transmitter power, on any frequency removed from the center of the authorized bandwidth by more than 250%. 47 C.F.R. § 95.935(b)(7). To the extent that family radios operating on Channels 8-14 are in close physical proximity to an SDARS receiver operating at present out-of-band emissions levels, they have the potential to cause interference to reception of SDARS.

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20 Amendment of Part 95 of the Commission's Rules to Establish a Very Short Distance, Two-Way Voice Radio Service, *Report and Order*, 11 FCC Rcd 12977 (May 1996).

21 Leonard Wiener, "Hello? Can you hear me? Walkie-talkies are the rage," U.S. News and World Report, p. 57 (July 2, 2001) (stating that 1.1 million family radios were sold in the first four months of 2001); Gary Shapiro, "Furnishing the Ultimate Living Room and Beyond," Appliance, p. 65 (January 1, 2001) (noting that sales of family radios will continue to grow in 2001).

22 Garmin International, Inc., *Notice of Proposed Rulemaking*, WT Docket No. 01-339 (Dec. 20, 2001).

Commission Concern with Rise in the Noise Floor from Unlicensed Devices. The Commission has begun to acknowledge an increase in the amount of noise and the potential for interference in the radio spectrum due to the proliferation of unlicensed devices. In June 2000, the Commission's Technological Advisory Council ("TAC") announced its interest in a study of radio spectrum noise and established a Spectrum Management focus group to study this issue.[23]

Unlicensed Device NPRM. In the above-captioned NPRM, the Commission proposes to modify its emissions limits on certain unlicensed devices operating above 2 GHz.[24] The Commission states that a review is needed to ensure "continued growth in the area of unlicensed devices while protecting against harmful interference to authorized services." NPRM at ¶ 2. While the SDARS licensees have expressed their concerns regarding out-of-band emissions of unlicensed devices operating in the 2400 - 2483.5 MHz band in the radio frequency ("RF") lighting,[25] ultra-wideband ("UWB"),[26] and spread spectrum device proceedings,[27] the

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23 A list of the TAC's focus groups is available at http://www.fcc.gov/oet/tac/focusgroups.html

24 *See* Review of Part 15 and Other Parts of the Commission's Rules, *Notice of Proposed Rulemaking and Order*, ET Docket 01-278 (Oct. 15, 2001) ("*Part 15 NPRM*").

25 In its NPRM on RF lighting, the Commission itself expressed concern with the potential for interference to SDARS from out-of-band emissions from RF lights. *See RF Lighting NPRM* at ¶ 12 ("We are particularly concerned that this [out-of-band] energy could cause interference to other services operating near the 2450 MHz band, such as the Digital Audio Radio Service operating in the 2320-2345 MHz frequency band."); *see, e.g.*, Comments of XM (f/k/a American Mobile Radio Corporation), ET Docket No. 98-42 (July 8, 1998); Reply Comments of XM (f/k/a American Mobile Radio Corporation), ET Docket No. 98-42 (August 7, 1998); Joint Comments of XM and Sirius, ET Docket No. 98-42 (May 4, 2001); Letter from Phil Barsky, XM, and Rob Briskman, Sirius, to Ms. Magalie Roman Salas, ET Docket 98-42 (June 29, 2001); Letter from Bruce D. Jacobs, Counsel for XM, and Carl R. Frank, Counsel for Sirius, to Ms. Magalie Roman Salas, ET Docket 98-42 (August 2, 2001).

26 *See, e.g.,* Comments of XM, ET Docket No. 98-153 (Sept. 12, 2000); Reply Comments of XM, ET Docket No. 98-153 (Oct. 27, 2000); Supplemental Comments of Sirius, ET Docket No. 98-153 (Feb. 23, 2001); Supplemental Reply Comments of Sirius, ET Docket No. 98-153 (March 12, 2001); Reply Comments of XM, ET Docket No. 98-153 (March 12, 2001); Comments of Sirius, ET Docket No. 98-153 (April 25, 2001); Reply

Footnote continued on next page

Commission does not specifically address these concerns in the NPRM. The Commission does note, however, that the above-captioned proceeding is intended as a general review and update of Part 15 and Part 18 of the Commission's Rules and of emissions limits from unlicensed devices operating above 2 GHz. NPRM at ¶¶ 1, 2-3, 7.

Discussion

I. THE COMMISSION'S EXISTING OUT-OF-BAND EMISSIONS LIMITS FOR UNLICENSED DEVICES ARE NOT ADEQUATE TO PROTECT SATELLITE DARS RECEIVERS AND SHOULD BE UPDATED

A. The Commission Has a Fundamental Obligation to Protect Licensed Services

The Commission has a fundamental obligation to protect licensed services such as SDARS from interference by emissions from unlicensed devices. The Commission's Part 15 and Part 18 rules establish an absolute obligation for operators of unlicensed devices to avoid causing harmful interference to licensed services.[28] For example, with respect to Part 15 devices, the Commission has stated that "the most basic principle of Part 15 operation is the requirement to

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Comments of Sirius, ET Docket No. 98-153 (May 10, 2001); Reply Comments of XM, ET Docket No. 98-153 (May 10, 2001).

27 *See Spread Spectrum FNPRM*; Reply Comments of XM, ET Docket No. 99-231 (September 25, 2001); *see also* Comments of Sirius, ET Docket No. 99-231 (August 27, 2001).

28 47 C.F.R. § 15.5(b) ("Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator."); 18.111(b) ("the operator of ISM equipment that causes harmful interference to any authorized radio service shall promptly take whatever steps may be necessary to eliminate the interference"); 18.115(a) ("The operator of ISM equipment that causes harmful interference to radio services shall promptly take appropriate measures to correct the problem.").

function in a non-interfering manner in the midst of licensed devices."[29] Similarly, the Commission's rules regarding the family radio service provide family radio operators and manufacturers with notice that the Commission may require technical changes to equipment to solve interference problems caused by harmonic emissions.[30] XM has relied on these fundamental Commission rules in bidding approximately $90 million for its SDARS license and in designing its SDARS system.

B. The Out-of-Band Emissions Rules Should be Updated

While the Commission's current rules may have been sufficient to protect all licensed services above 1000 MHz in 1989-1990, circumstances have changed with respect to the deployment of both licensed and unlicensed devices and the old rules are no longer adequate.

1. There Were Previously No Consumer-Oriented Mass Media Services Above 960 MHz

The Commission places particular emphasis on protecting consumer-oriented communications services such as broadcast television and radio from harmful interference.[31] In 1979, the Commission imposed a tougher emissions standard on computer devices (now called

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29 Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices, *First Report and Order*, 15 FCC Rcd 16244, ¶ 25 (August 31, 2000).

30 47 C.F.R. § 95.635 Note 4 ("If spurious or harmonic emissions result in harmful interference (any transmission, radiation or induction that endangers the functioning of a radionavigation or other safety service or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with applicable laws, treaties and regulations), the FCC may, at its discretion, require appropriate technical changes in the station equipment to alleviate the interference, including the use of a low pass filter between the transmitter antenna terminals and the antenna feed line.").

31 The Commission has also worked to protect satellite services from interference caused by the operation of unlicensed devices, in recognition of the vulnerability of satellite downlinks to interference, due to their typically low carrier-to-noise ratios. *See 1989 Part 15 Order* at ¶ 61 n.22. In fact, several of the Commission's restricted bands are satellite downlink bands, and the Commission in 1985 specifically precluded the operation of spread spectrum devices in a portion of the 5 GHz band already allocated to FSS. *Spread Spectrum Order* at ¶ 24.

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"digital devices" in Part 15) used in residential environments than on computer devices used in commercial or industrial settings; this policy was designed to protect consumers' use of televisions and radios in the home.[32] The Commission explained that "[w]hile the precise size of the benefits is difficult to measure, it is clear that the benefits of television viewing and radio services -- both services with which computers can interfere -- are substantial." *Computer Order* at ¶ 68.

Ten years later, in the *1989 Part 15 Order*, the Commission stated that tightening of its Part 15 rules was necessary "to reduce interference to authorized radio services, in particular, the AM broadcast service,"[33] and indicated that few if any unlicensed intentional radiators would be certified to operate in the TV band in order to protect future HDTV operations. *1989 Part 15 Order* at ¶ 51. While the Commission has not classified the broadcast TV frequency band as a "restricted" band, it has provided broadcast TV with protection from interference by denying requests to certify unlicensed devices to transmit in the TV band.[34]

Footnote continued from previous page

32 *See* 47 C.F.R. § 15.3(h), (i); Amendment of Part 15 to Define and Clarify the Rules Governing Radiating Devices and Low Power Communication Devices, *First Report and Order*, 69 FCC 2d 28 (1979) ("*Computer Order*"). In addition, the Commission on reconsideration stated that, "[i]n the home, the TV and AM/FM broadcast receivers are the most susceptible to interference from a computing device. For protection of radio and TV reception in the home, the Commission is adhering to the radiation limits proposed in the Notice with some relaxation at the higher frequencies." Amendment of Part 15 to Define and Clarify the Rules Governing Radiating Devices and Low Power Communication Devices, *Order Granting in Part Reconsideration of First Report and Order*, 79 FCC 2d 67, ¶ 52 (1980).

33 *1989 Part 15 Order* at ¶ 13.

34 Amendment of Part 15 of the Commission's Rules to Permit Operation of Biomedical Telemetry Devices on VHF TV Channels 7-13 and on UHF TV Channels 14-46, *Report and Order*, 12 FCC Rcd 17828, ¶ 5 (1997) ("*Biomedical Telemetry Order*"). As an exception to this policy, certain medical telemetry devices are permitted to transmit in the

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When the relevant out-of-band emissions limits were adopted in 1989-1990, there were no consumer-based mass media services authorized above 960 MHz. As a result, despite the fact that the 500 μV/m at 3 meters standard currently applicable to Part 15 devices is significantly more liberal than the out-of-band emissions limits below 960 MHz (for instance, the limit at 216-960 MHz is 200 μV/m at 3 meters), the Commission apparently viewed this limit as stringent enough to protect the licensed services above that frequency threshold. 47 C.F.R. § 15.209.

With the subsequent allocation and licensing of SDARS in the S-band, however, the Commission needs to maintain its traditional policy of protecting consumer-oriented communications services, and it should revisit its out-of-band emissions limits above 1000 MHz. Even more than other media services, the success of SDARS relies on its ability to deliver high-quality performance. If SDARS listeners experience chronic interference and loss of audio, even if those interruptions are intermittent and for a short duration, high quality service will be lost. New classes of unlicensed devices, many of which are being developed for widespread deployment in a mobile environment, could cause chronic interference to SDARS receivers.

In 1989, when the rules were last revised, the vast majority of unlicensed intentional radiators were used in a small number of residential or commercial environments and few, if any, were designed for use in automotive settings. In fact, in establishing the 500 μV/m at 3 meters out-of-band emissions limit for unlicensed intentional radiators above 960 MHz in 1989, the Commission emphasized that this was the limit applied one year earlier to remote control devices and in-building security alarm transmitters, the presumed prototype devices above 960 MHz. *1989 Part 15 Order* at ¶¶ 26, 73-74. In the 1988 Order regarding those devices, the Commission

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TV band subject to numerous strict operating conditions. *See, e.g., Biomedical Telemetry*

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explained that (i) emissions above 960 MHz are vulnerable to blockage by physical obstacles and generally do not travel far enough to pose a substantial threat of interference, and (ii) the remote control and security devices at issue are typically installed or used in enclosed areas.[35]

The Commission's rationale for a uniform limit of 500 μV/m at 3 meters for devices operating above 960 MHz is no longer valid today. These unlicensed devices are no longer limited to remote control devices, security alarms, and other niche products. Now, broad-based initiatives such as Bluetooth, 802.11b, and HomeRF promise consumers a wide range of unlicensed communications and information services across a variety of environments, including many services in automotive settings where SDARS subscribers are likely to do most of their listening. As indicated above, it is likely that *millions* of these unlicensed transmitters, including spread spectrum devices in the 2.4 GHz band, will soon be entering the RF environment in the United States. As a result, there is a high probability that these devices will frequently be used in close proximity to operating SDARS receivers, and the shorter range of transmissions above 960 MHz is therefore no longer a legitimate justification for a less stringent standard above that threshold.

Footnote continued from previous page

Order.

[35] Amendment of the Rules Regarding Control and Security Alarm Devices Under Part 15, *Report and Order*, 3 FCC Rcd 1702, ¶ 16 (1988). The Commission's more general application of this 500 μV/m at 3 meters standard to all intentional radiators above 960 MHz was also based on a recommendation from the NTIA, but the NTIA report at issue fails to provide any explanation for the effectiveness of that limit. *See 1989 Part 15 Order* at ¶ 20; "Technical Subcommittee (TSC) Review of the Federal Communications Commission's Draft Notice of Proposed Rule Making in the matter of Revision of Parts 2 and 15 of the Rules Regarding the Operation of Non-licensed Radio Frequency Devices,"

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2. The Commission Has Acknowledged the Importance of Updating Its Unlicensed Device Rules in Response to Changing Circumstances, and Such Changed Circumstances Are Present in This Case

The Commission has explicitly acknowledged that rules for unlicensed devices established at one point in time may no longer be appropriate or effective at a future time, as a result of relevant technological, commercial, and regulatory developments. In its 1989 Order establishing a new Part 15 framework, the Commission stated the following:

> Early standards adopted to control interference are frequently significantly different from what is needed at the present time due to improvements in equipment, such as receiver sensitivity, the increased proliferation of both licensed and non-licensed operations, and changes to the frequency allocations of authorized radio services. *Part 15 Order* at ¶ 4.

As described above, the circumstances in the RF environment above 960 MHz, and in particular in the vicinity of the 2.4 GHz band, have changed dramatically since 1989 when the Commission established its general emissions limits. As the Commission acknowledges in the NPRM:

> The last significant change to these [emissions] limits was made in 1989, so they have been essentially unchanged for over ten years. During this period, the commercial use of spectrum above 2 GHz has increased significantly. Licensed and unlicensed devices operating above 2 GHz have proliferated . . . . *NPRM* at ¶ 6.

Given these changes, there is no longer any justification for the continued general applicability of the Commission's current out-of-band emissions limit above 960 MHz. The Commission should do "what is needed at the present time" (*1989 Part 15 Order* at ¶ 4) to provide sufficient protection to SDARS, and update its emissions limits as described in the section below.

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National Telecommunications and Information Administration, U.S. Department of

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II. THE FCC SHOULD REVISE ITS OUT-OF-BAND EMISSION LIMITS FOR UNLICENSED DEVICES OPERATING IN THE 2.4 GHZ BAND AND FAMILY RADIOS OPERATING ON CHANNELS 8-14

A. Without More Stringent Emission Limits, Unlicensed Devices Operating in the 2.4 GHz ISM Band and Family Radios Operating on Channels 8-14 Will Cause Harmful Interference to SDARS Reception

SDARS licensees are somewhat more susceptible to out-of-band interference from unlicensed devices than other licensees. First, the upper edge of the SDARS frequency band is only 55 MHz from the lower edge of the 2400 –2483.5 MHz band where many unlicensed devices operate. In addition, for XM, the transmitted fifth harmonic of family radios operating on Channels 8-14 fall within XM's licensed frequency band of 2332.5 – 2345 MHz. Second, the downlink signal power available to an SDARS receiver is much lower than terrestrial-based communications systems, thereby requiring very sensitive SDARS receivers.[36] In addition, because SDARS receivers operate in a mobile environment, they use omnidirectional antennas that eliminate the ability to "point" an antenna away from a source of interference. Third, unlike cellular, PCS, and other wireless telecommunications services, SDARS is a broadcast service from which consumers demand extremely high-quality service. With a digital broadcast system, the loss of an adequate signal can produce a total loss of audio. While people using mobile phones have accepted the fact that intermittent outages or bursts of noise occur during the course of a conversation, intermittent outages or bursts of noise will not be tolerated by an SDARS subscriber who is paying for uninterrupted, high-quality digital radio.

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Commerce (November 5, 1986).

[36] XM provides service to its subscribers directly through its licensed SDARS satellites in over 99% of its coverage area.

As described in Exhibit A, in order to provide SDARS receivers with reasonable protection from harmful interference, the Commission must establish new, more stringent out-of-band emissions limits in the 2320-2345 MHz band. Specifically, XM urges the Commission to establish an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 μV/m at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside of vehicles and 8.6 μV/m at 3 meters measured in a 1 MHz interval for all unlicensed devices in all other environments. These limits will apply to all unlicensed devices operating pursuant to Part 15, Part 18 devices operating in the 2.4 GHz band, and to family radios operating on Channels 8-14.

The current Part 15 limit of 500 μV/m equates to an out-of-band emissions level of –41 dBm/1MHz at the source. As discussed in Exhibit A, at –41 dBm, the separation distance required to ensure that the out-of-band emissions would not interfere with the SDARS receiver would be approximately 30 meters. Clearly, there is no way to achieve this type of separation distance if an unlicensed device is operating in an automobile or in the same room as an SDARS receiver. In the case of RF lighting devices, even though the distance between the SDARS antenna and the light could be 20 feet, its enormous transmit power, if not limited to the same 8.6 μV/m at 3m level, would overpower the SDARS satellite signal.

XM's proposed out-of-band emissions limits are less stringent for unlicensed devices that operate exclusively in a vehicle. This is because an XM receiver in a vehicle operates with a roof mounted antenna that is shielded from an unlicensed device operating inside of the vehicle by the metal of the roof as well as the silvering on the glass.[37] In a home environment, however,

[37] XM has begun discussions with the Automotive Multimedia Interface Collaboration (AMIC), which develops technical specifications for electronic systems installed in

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an unlicensed device, such as a 2.4 GHz cordless phone, could operate directly next to a SDARS antenna placed on a window sill, causing harmful interference. In addition, devices that are capable of operating outdoors, such as RF lights or a mobile phone or a laptop equipped with a Bluetooth device, could operate in close proximity to a roof-mounted SDARS antenna without the benefit of shielding. Thus, to the extent an unlicensed device can operate both inside an automobile and outdoors or in a home, such as a mobile phone or laptop equipped with a Bluetooth device, then the Commission should apply the more stringent emissions limit of 8.6 μV/m at 3 meters to that device.

Accordingly, XM asks the Commission to amend Part 15, Part 18, and Part 95 of its rules to specify an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 μV/m at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside vehicles and 8.6 μV/m at 3 meters measured in a 1 MHz interval for all other unlicensed devices.

B. There Is Ample Precedent for an Out-of-Band Emissions Limit of 8.6 mV/m at 3 Meters to Protect SDARS

The more stringent of the two out-of-band emissions limits XM proposes herein -- 8.6 μV/m at 3 meters measured in a 1 MHz interval for all devices not used exclusively in vehicles -- is actually less stringent than the out-of-band standard the Commission has imposed on WCS mobile devices to protect SDARS receivers.[38] In adopting this standard, the Commission noted

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vehicles. XM expects AMIC to issue a specification which requires all RF devices operating exclusively in cars to meet XM's proposed 18 μV/m at 3 meter standard for the DARS band.

[38] *See* 47 C.F.R. § 27.53(a)(2). For WCS licensees operating in the 2305-2320 MHz and 2345-2360 MHz bands, the power of any emission in the DARS band must be attenuated below the transmitter power (P) by a factor of 110 + 10 log (p) dB. Assuming a 1 watt

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that "[w]hile it is our desire to provide WCS licensees with the maximum flexibility to provide a wide range of services, we also must ensure that WCS operations do not cause harmful interference or disruption to adjacent satellite DARS reception." *WCS Order* at ¶ 136.

In addition, XM's proposed interference limit is higher than the limit negotiated by the FCC for terrestrial interference into SDARS receivers from Canadian and Mexican terrestrial systems near the border.[39] Thus, there is ample precedent for 8.6 μV/m at 3 meters as the appropriate out-of-band emissions limit needed to adequately protect sensitive SDARS receivers from harmful interference from adjacent channel operations.

C. The Commission Must Act Now to Update Its Emissions Limits Before Unlicensed Devices Begin to Saturate the Market

The Commission must act quickly to adopt the emissions limits proposed herein. Attached is a study prepared by Comsearch which concludes that out-of-band interference from unlicensed devices into the SDARS band is minimal at the present time. *See* Exhibit B. Thus, at present, SDARS consumers can expect high-quality service. With the expected proliferation of unlicensed devices in the 2.4 GHz band and family radios in the coming years, however, this expectation is in jeopardy. Thus, now is the time for the Commission to act to ensure that these devices do not interfere with SDARS.

In addition, unlike XM, the manufacturers of unlicensed devices can take the steps necessary to prevent interference to SDARS reception. While SDARS radios are already in production and in the marketplace, XM understands that many of the different kinds of devices

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WCS mobile transmitter, this equates to a signal level of –80 dBm. XM's proposed standard of 8.6 μV/m at 3 meters equates to a signal level of –79.4 dBm.

expected to produce interference, such as Bluetooth devices, have yet to enter the manufacturing process. There is still time to make the necessary modifications to this equipment. Unlike SDARS radios, the necessary modifications can be made to these devices without jeopardizing the quality of their performance or their commercial viability. Thus, by acting now or in the near future, the Commission can prevent a serious problem from developing, and can do so at minimal cost.

D. Compliance With the Proposed Emissions Limits Is Technologically Feasible and Can Be Done at Minimal Cost

It is technologically feasible for unlicensed device manufacturers to comply with the emissions limits proposed herein, and they can do so at minimal cost. To do so, manufacturers will simply need to modify the existing design in order to meet the transmit mask as defined by the new emissions requirements and, if necessary, employ a notch filter at the SDARS frequencies. These technological fixes are expected to be of minimal cost. In fact, some Bluetooth device manufacturers are already meeting the emissions limits proposed herein. In addition, XM has led discussions with the Automotive Multimedia Interface Collaboration ("AMIC"), which has indicated that Bluetooth and other unlicensed RF devices to be employed in automobiles will be required to meet an out-of-band emissions limit of 18 μV/m at 3 meters measured in a 2 MHz interval into the SDARS band.

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[39] *U.S.-Mexico DARS Agreement*; *Agreement Concerning the Coordination between U.S. Satellite Digital Audio Radio Service and Canadian Fixed Service and Mobile Aeronautical Telemetry Service in the band 2320-2345 MHz*.

E. Unlicensed Device Manufacturers Should Be Afforded Eighteen Months After Final Rules Are Adopted to Comply with the Emissions Limits Proposed Herein

XM understands that it would be impossible for the Commission to retroactively apply these emissions limits to existing devices. XM also understands that unlicensed device manufacturers need sufficient notice of these new emissions limits to accommodate the design changes required to meet the new transmit mask or, if necessary, to add the filters needed to meet these limits. For this reason, XM believes the Commission should apply the proposed field strength limitations only to products sold 18 months after a final rule is published. XM understands that grandfathered unlicensed devices may present an interference concern, but believes that such a sacrifice is necessary to afford unlicensed device manufacturers a smooth transition to the new standards.

Conclusion

For all of the aforementioned reasons, the Commission should adopt XM's proposals and update its Part 15, Part 18, and Part 95 rules to establish, effective 18 months after adoption, an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 μV/m at 3 meters measured in a 2 MHz interval for all unlicensed devices operating exclusively inside of vehicles and 8.6 μV/m at 3 meters measured in a 1 MHz interval for unlicensed devices operating in all other environments.

Respectfully submitted,

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Date: February 12, 2002

Technical Certification

I, Phillip Barsky, Consultant - Spectrum Management/Regulatory for XM Radio Inc., certify under penalty of perjury that:

I am the technically qualified person with overall responsibility for the preparation of the technical information contained in the above "Comments." The information contained in this document is true and correct to the best of my belief.

Phillip Barsky

Dated: February 12, 2002

Exhibit A

Interference from Bluetooth Devices to Satellite DARS Receivers

I. Scope

This preliminary document is intended to address the potential impact of the Bluetooth transceiver out of band emissions when co-located with SDARS receiver. This analysis was performed for the automotive environment.

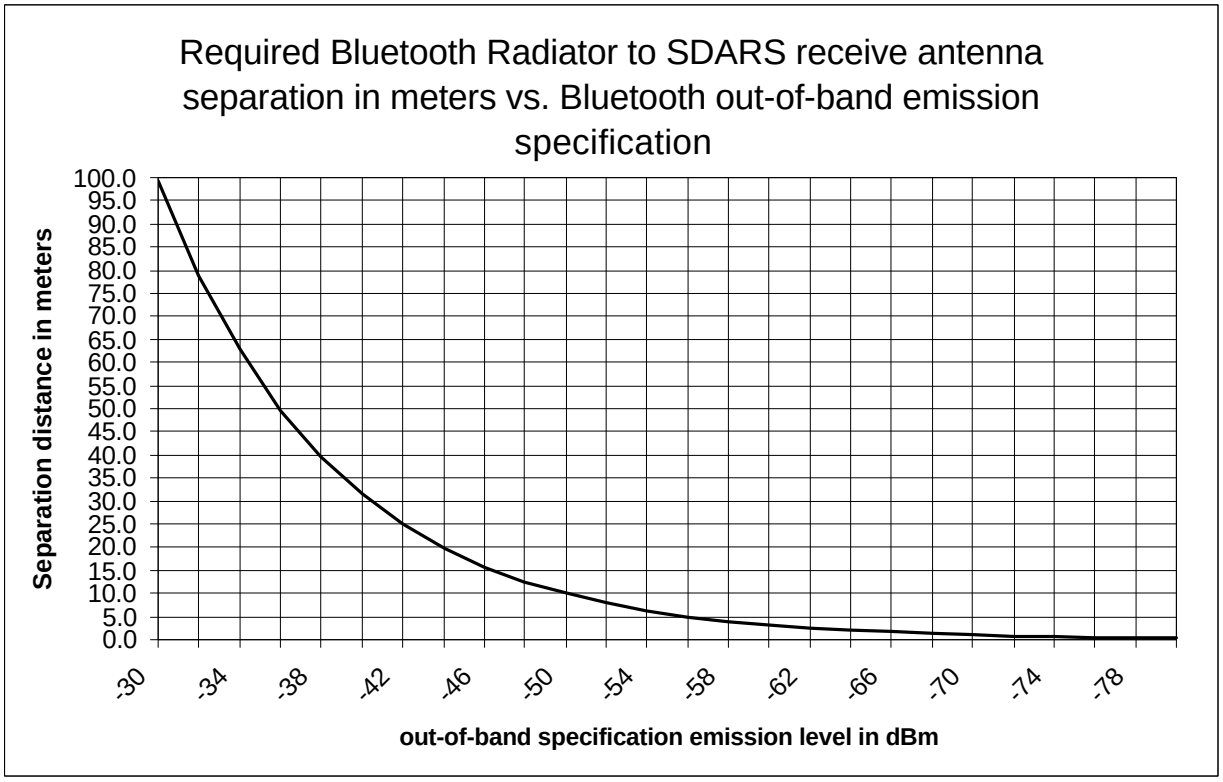
II. Summary

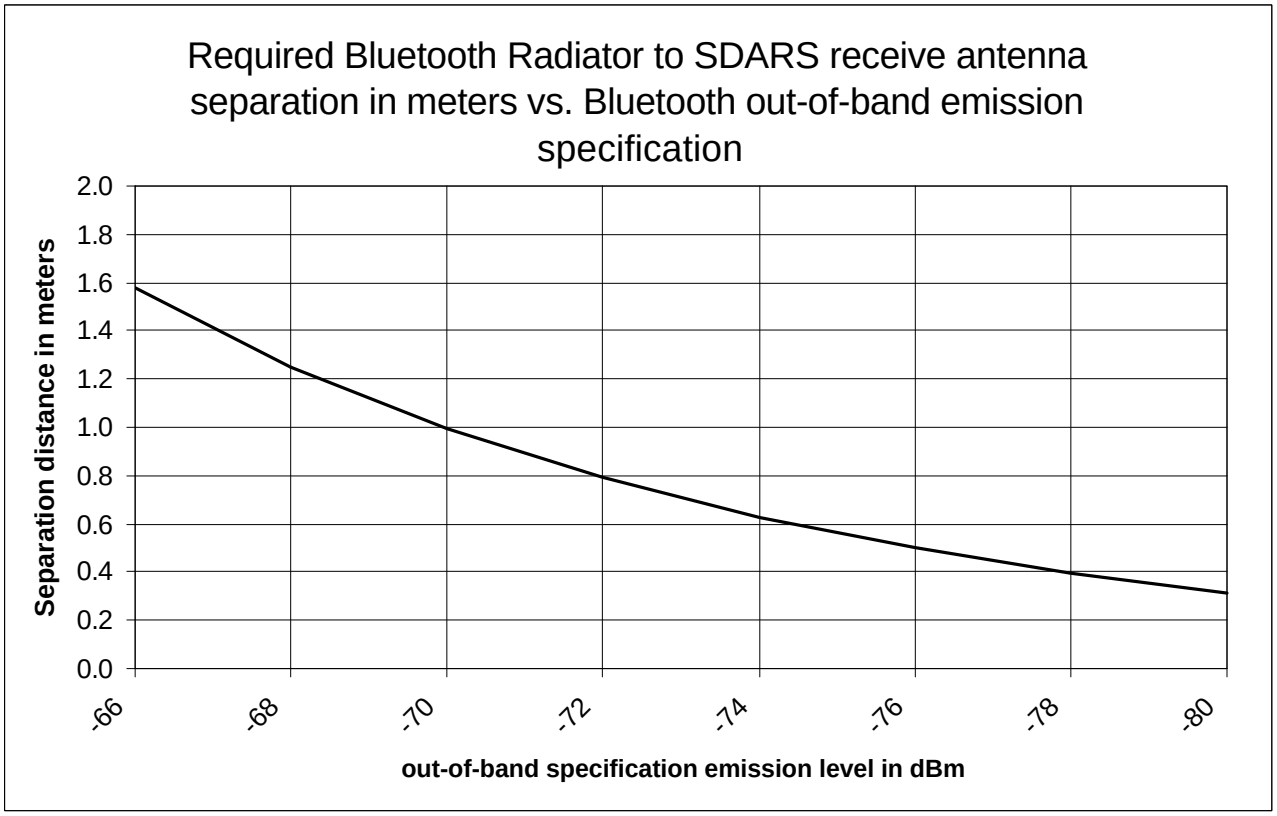
The Bluetooth transceiver operates in the 2.4 GHz ISM band. Bluetooth transceivers operate under approval of the following Standards: Federal Communications Commission, FCC, USA Documents: CFR47, Part 15, Sections 15.205, 15.209, 15.247.

The Bluetooth out of band emissions specification limits the emissions in the frequency range of 1 GHz – 12.75 GHz to -30 dBm for active mode and -47 dBm for idle mode.

The value of thermal noise at the XM receiver input is -110 dBm (290 degree noise temperature and 2 MHz noise bandwidth). The additional increase of the noise floor in the SDARS band due to the allowable out-of-band emissions reduces the available SDARS Satellite link margin. This indicates the isolation required between the Bluetooth radiator and the SDARS receive antenna is 80 dB.

The following charts illustrate the separation distance between Bluetooth a radiator and SDARS receiver in a line of site condition that is required to achieve the 80dB of isolation and limit the effect of Bluetooth out-of-band emissions on the reliability of the SDARS service.





III. FCC Specification

The current FCC specification of 500 microvolts per meter equates to an out of band emissions level of –41 dBm. This level is well below that stated in the Bluetooth specification but does not eliminate the requirement for an improvement in the current limit. At –41 dBm the separation distance required to ensure that the out of band emissions would not interfere with the SDARS receiver would be approximately 30 meters.

IV. Recommended FCC Specification Change

The current requirement for the FCC limits should be modified to restrict the emissions level limit for the 2320-2345 MHz to no more than –100 dBW (1.8 microvolts per meter at 30 meters or 18 microvolts per meter at 3 meters)- all measured in a 2MHz bandwidth . The SDARS system is designed to be primarily a direct Satellite broadcast system with a very high target availability (>99%) and as such operates at very low signal to noise level and is therefore very any additional in band noise impacts the service reliability.

V. Conclusion

The allowable out-of-band emissions limit for the Bluetooth transceiver in the SDARS band of operation should be reduced to at –100dBW over a 2 MHz measurement interval. This would allow co-location of Bluetooth transceivers and SDARS receivers within one meter of each

other. This analysis has assumed that 6db of attenuation will be realized from the car roof. When we reduce the interfering level by 6 dB, the signal level then becomes 6dB below the DARS receiver noise floor.

Exhibit B

Comsearch Study

Document #: 1213602 v.1

RADIO FREQUENCY INTERFERENCE (RFI) MEASUREMENT REPORT

Prepared For

XM Radio
Washington, DC

February 2002

19700 Janelia Farm Blvd. Ashburn, Virginia USA 703-726-5500

TABLE OF CONTENTS

SECTION

ONE

SECTION 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

Radio Frequency Interference (RFI) measurements were performed for XM Radio between the dates of January 16, 2001 and January 21, 2002 at various points in the surrounding Washington, DC area. The purpose of these measurements was to determine the relative RFI levels in the DARS frequency band from 2320-2345 MHz especially from systems operating in adjacent bands and other spurious emissions. These adjacent bands include the ISM band (2400-2483.5 MHz) and the WCS bands (2300-2320 and 2345-2365 MHz). Measurements were performed at eight different locations, which were classified as urban, suburban, or rural. The purpose of this report is to document the results of the measurements that were performed and to characterize the electromagnetic environment in the DARS band and to then compare the results to measurements performed by Comsearch in the DARS band previously.

The previous measurement activity and the reports is:

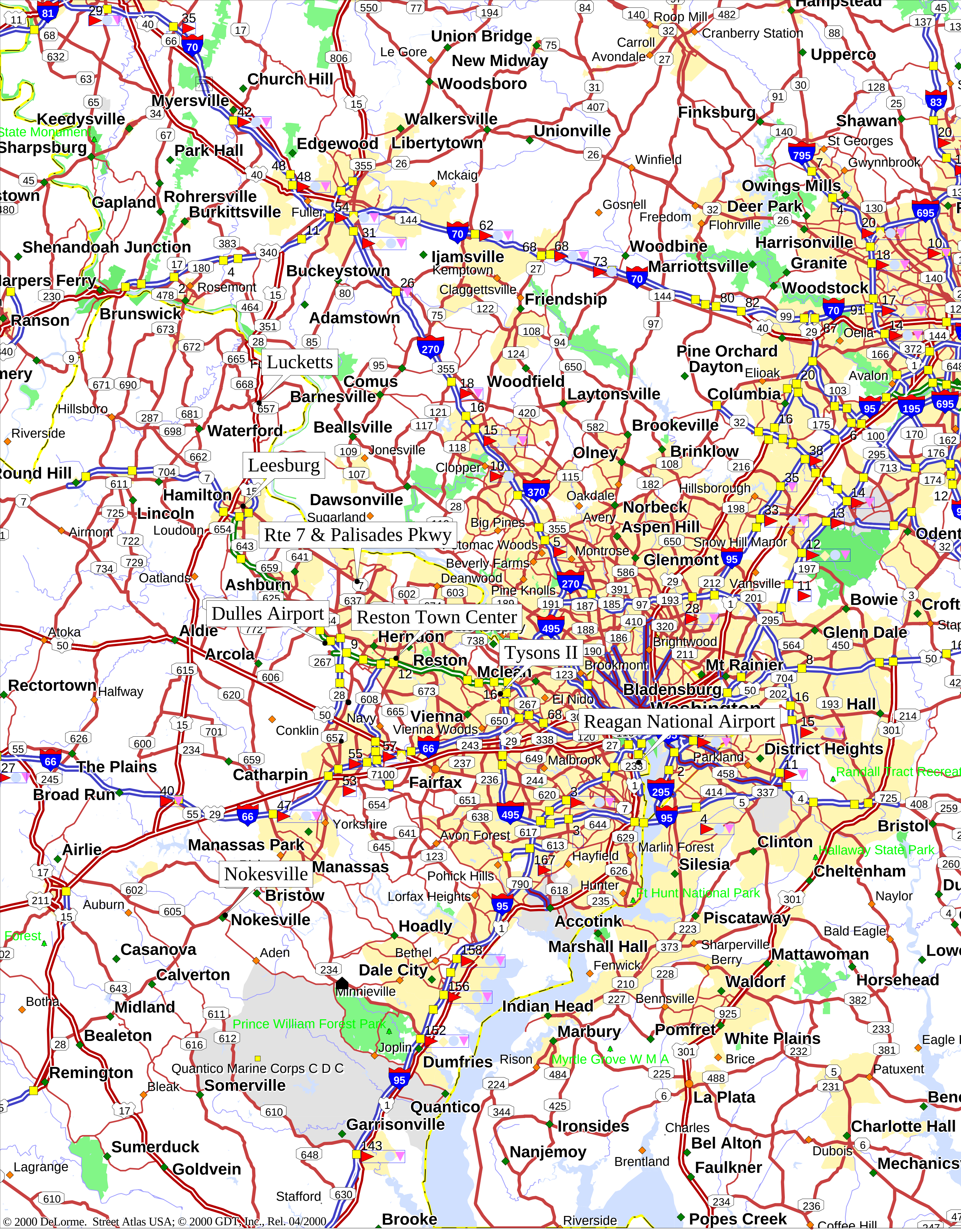
Survey of the XM Radio Electromagnetic Spectrum in the Northern Virginia Metropolitan Area, October 9 - October 29, 2000

- Frequency Range Considered: 2300 to 2500 MHz
- Type of Reception: Digital
- Measured Antenna Center Line: 10 Feet

1.2 Background

XM Radio contacted Comsearch to perform interference measurements in the DARS frequency band from 2320- 2345 MHz. Measurements were requested across the WCS and ISM Bands (2300-2483.5) MHz. Measurements were conducted in various settings to include urban, suburban, and rural environments.

The measured sites are identified on a portion of a map shown on the following page.



1.3 Constraints

The analysis in this report is based upon the following assumptions and constraints.

- It is assumed that during the measurement period all of the 2.4 GHz transmitters were active and operating at full transmit power.

SECTION

TWO

SECTION 2

TEST PROCEDURE

2.1 Calibration

Figures 2.1-1, 2.1-2, and 2.1-3 are the block diagrams of the 2.4 GHz test set. All test equipment used was allowed a proper warm-up period prior to calibration. The test set was calibrated by the signal substitution method, as recommended by NSMA, utilizing a synthesized signal generator. The reference signal from the signal generator was adjusted for the frequency of test (2400 MHz) and measured with a thermal power meter for calibrated reference test level (-60 dBm). This calibrated reference signal from the signal generator was then injected into the end of the coaxial cable of the test set at the point that normally connects to the test antenna. A spectrum analyzer then measured the reference test signal level after passing through the test set. Upon completion of the calibration process, a known reference level was obtained for the measurements that corresponds to a given set of spectrum analyzer display readings.

The following formula is used to transform the measured signal level as read on the spectrum analyzer display (dBm) to an isotropic reference signal level (dBW_I) as seen at the point of test:

$$dBW_I = LI - GA - 30$$

Where: dBW_I = Isotropic level in dBW

LI = Level (dBm) of injected signal

GA = Test antenna gain (17.5 dBm at 2.4 GHz)

-30 = Conversion factor from dBm to dBW

at 2.4 GHz: dBW_I = -60 dBm – 17.5 dB - 30 dB

= -107.5 dBW_I

In this instance, the spectrum analyzer displayed measured signal level of -60 dBm equates to an isotropic signal level of –107.5 dBW_I.

Figures 2.1-2A, 2.1-2B, and 2.1-3A display the spectrum photographs of the described calibration procedure employed during measurements using various filter arrangements.

Figure 2.1-3B shows the output of a –10 dBm signal swept across two notch filters which

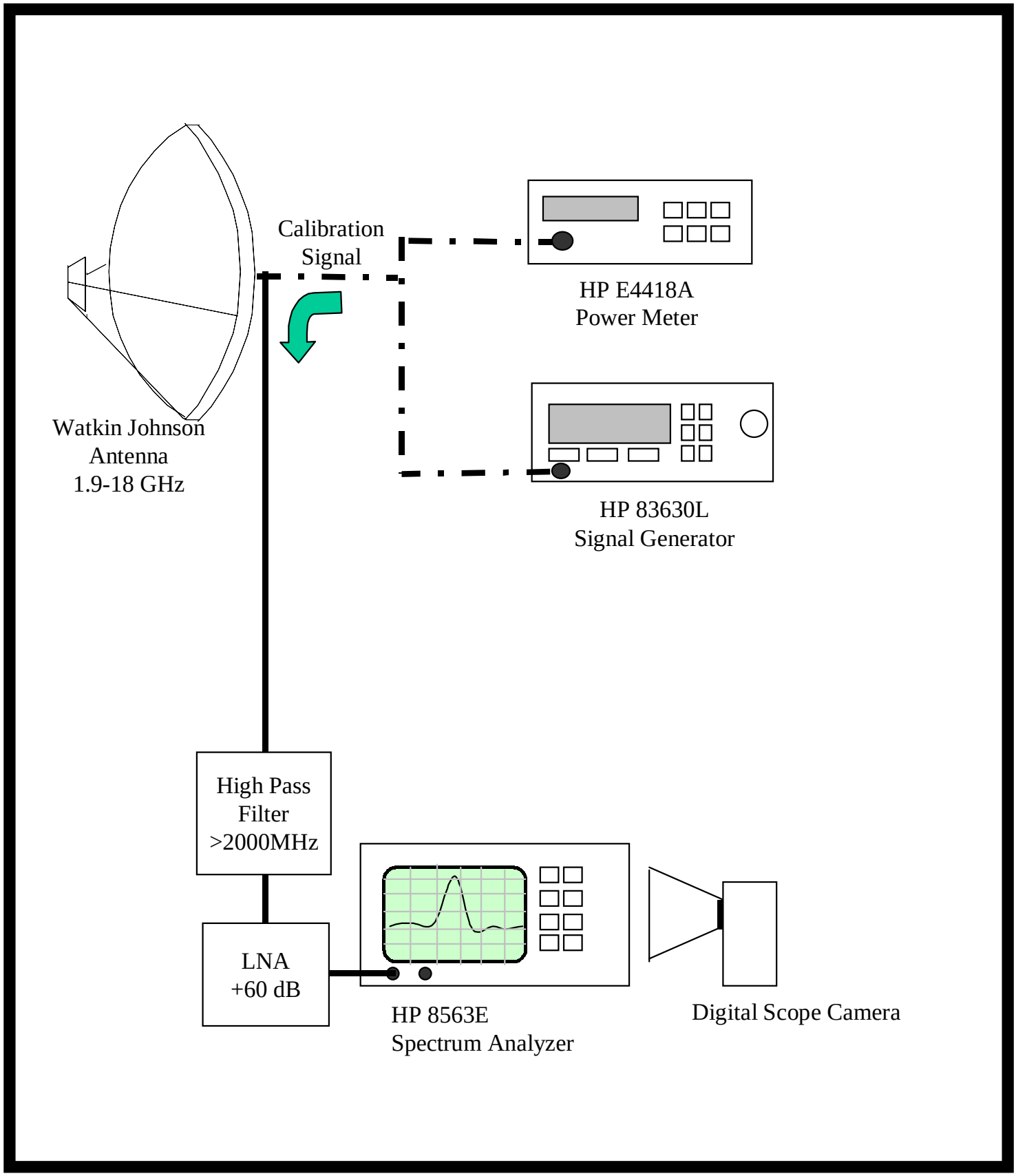


Figure 2.1-1 Test Equipment Block Diagram

COMSEARCH

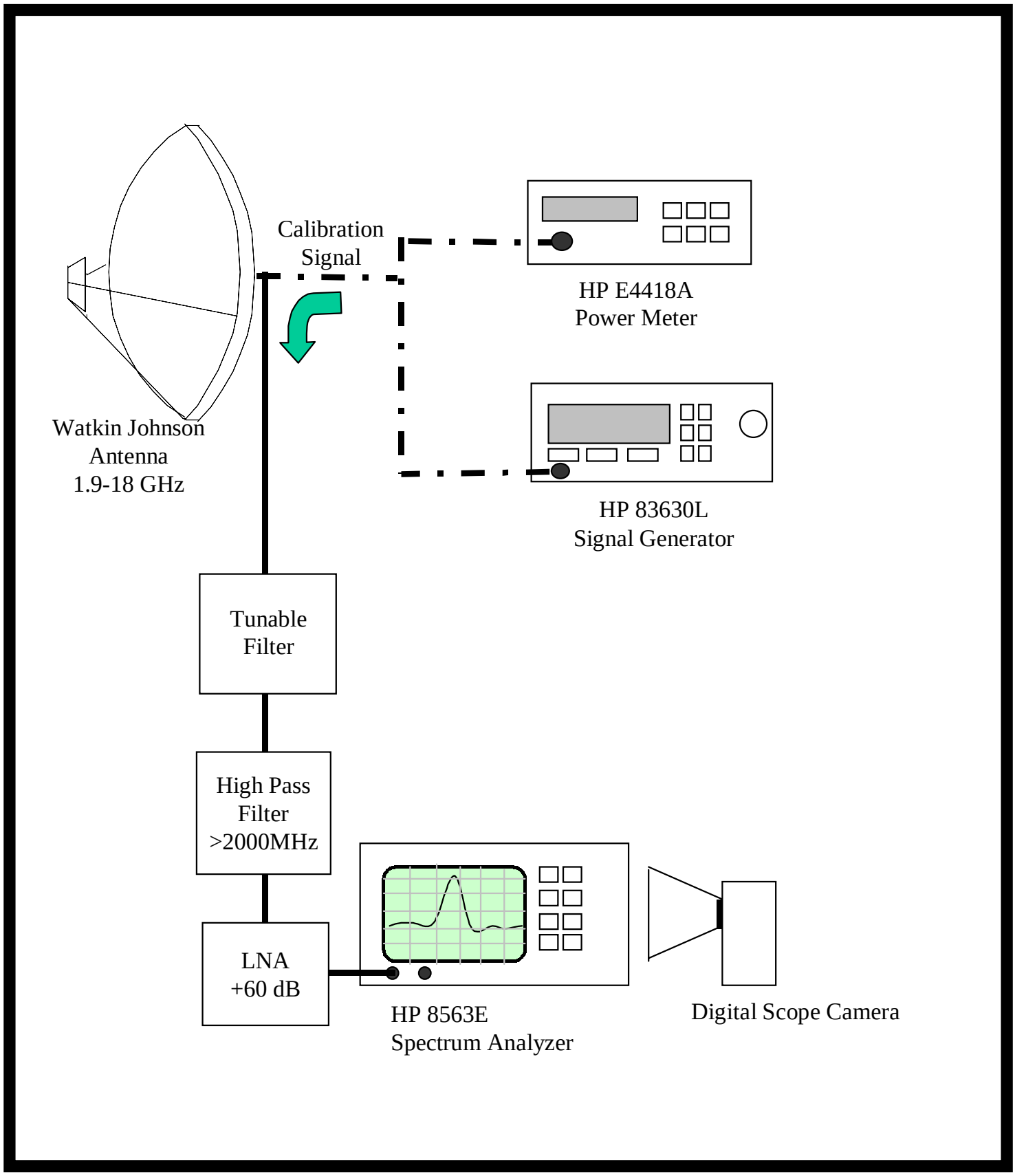


Figure 2.1-2 Test Equipment Block Diagram

COMSEARCH

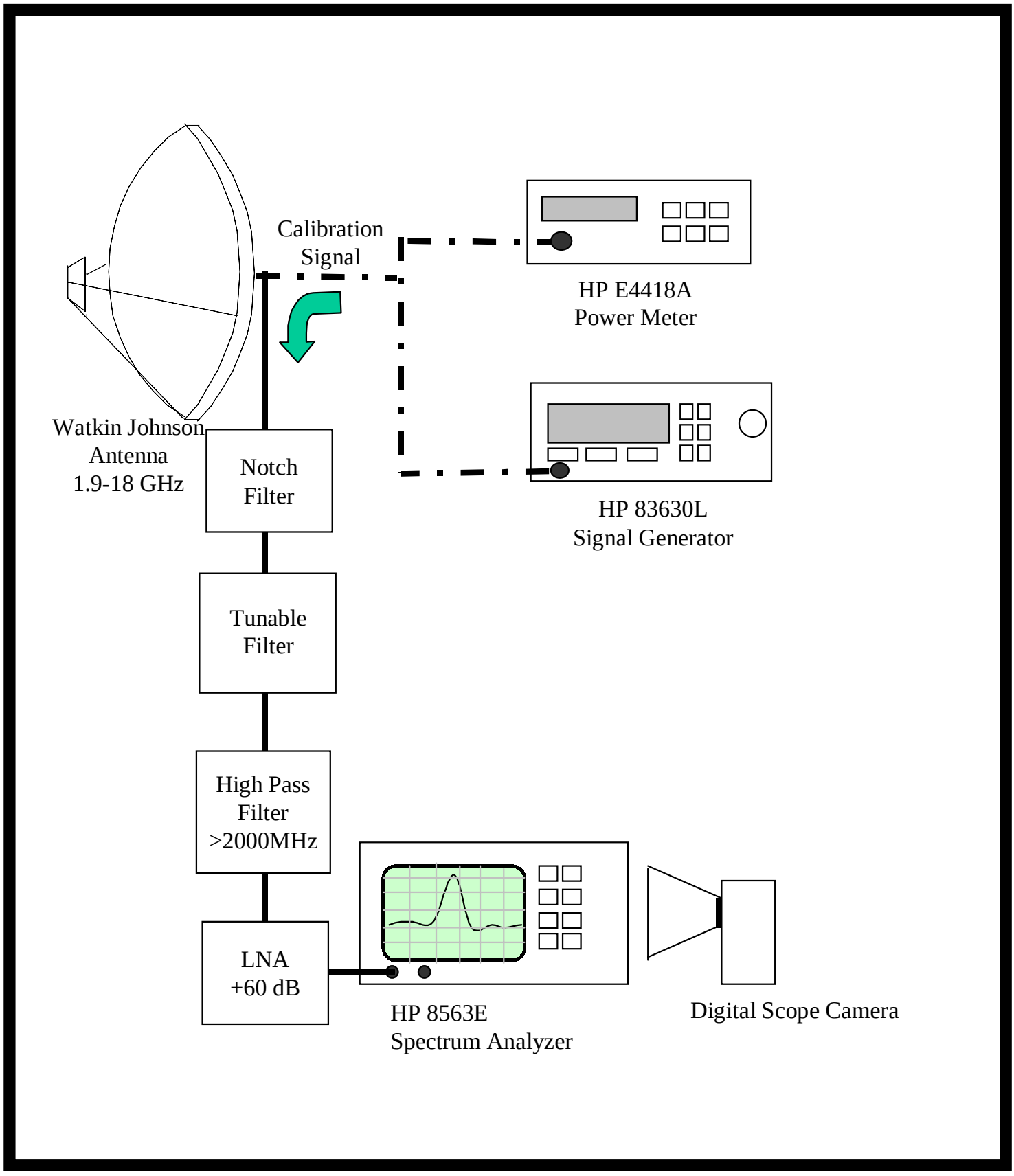


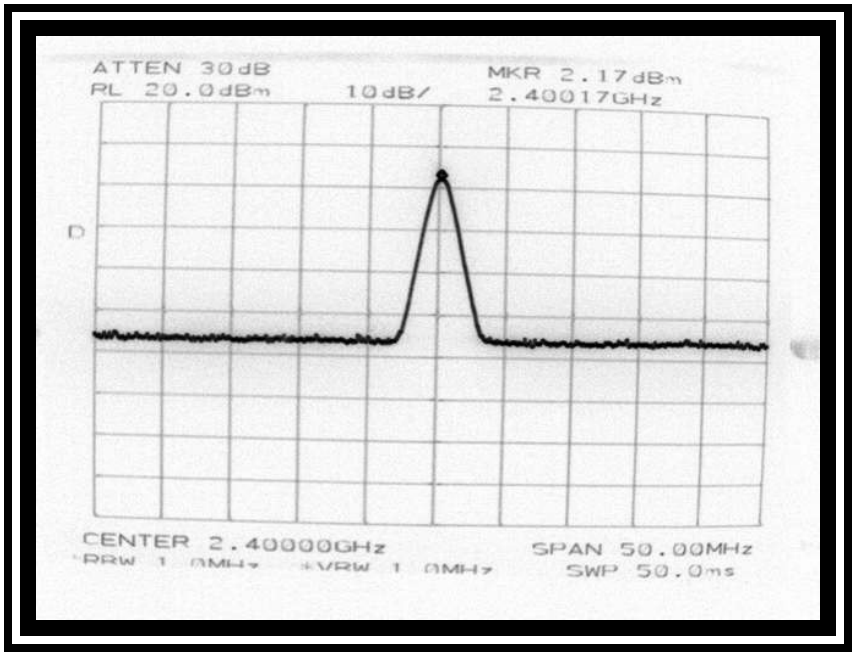
Figure 2.1-3 Test Equipment Block Diagram

COMSEARCH

Reference Level dBW_I

XM Radio

-89.5



(A)

High-Pass Filter

Date: January 16, 2002
Center Freq: 2400 MHz
Span/Div: 50 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

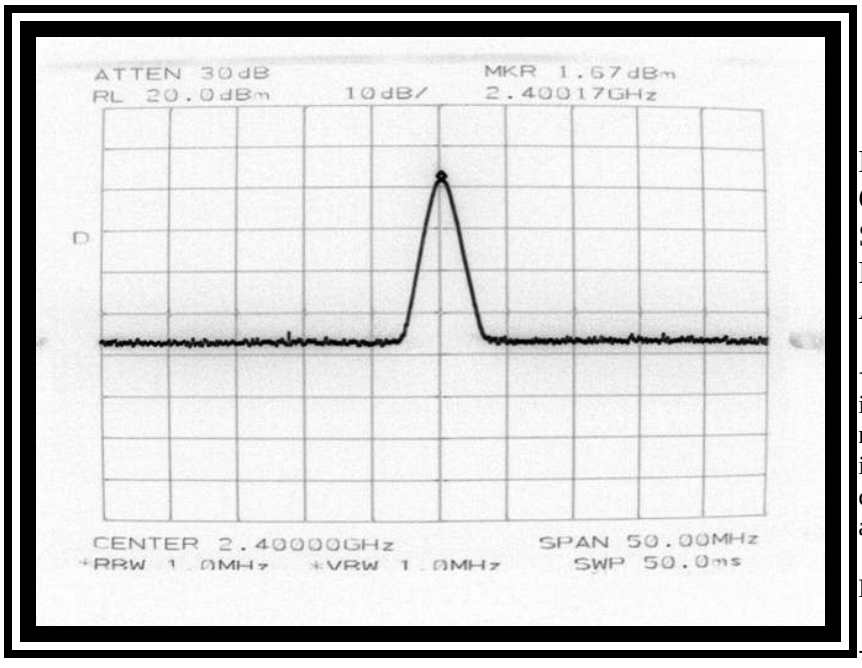
+2.17 dBm, 2400 MHz signal indication on the spectrum photograph represents a -60 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

Displayed reference level is equal:

-60 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-107.5 dBW_I; therefore, a displayed signal level of +20 dBm equals an isotropic level of –89.5 dBW_I.

Reference Level dBW_I

-89



(B)

High-Pass and Tunable Filters

Date: January 16, 2002
Center Freq: 2400 MHz
Span/Div: 50 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

+1.67 dBm, 2400 MHz signal indication on the spectrum photograph represents a -60 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

Displayed reference level is equal:

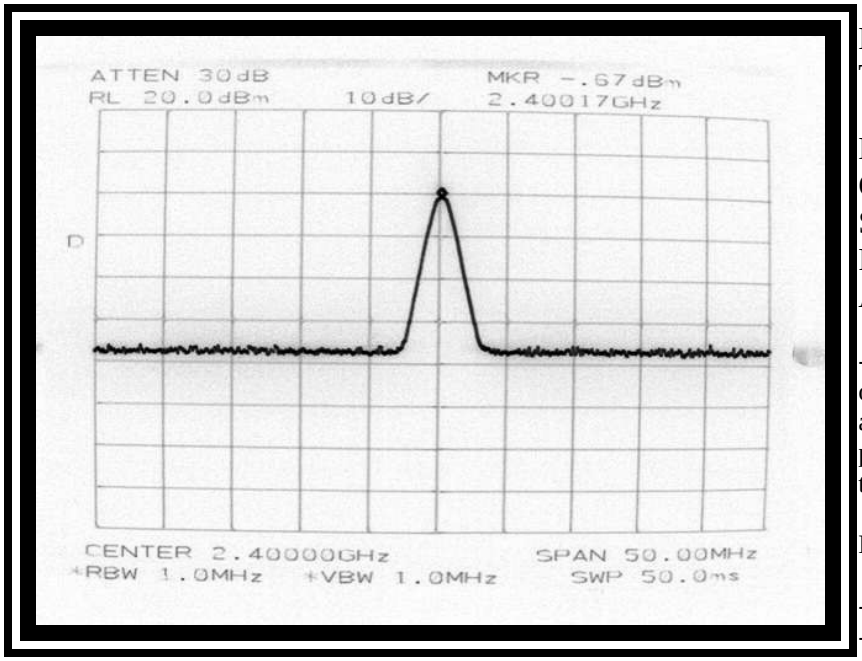
-60 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-107.5 dBW_I; therefore, a displayed signal level of +20 dBm equals an isotropic level of -89 dBW_I.

Figure 2.1-2 RF Calibration Photographs

Reference Level dBW_I

XM Radio

-87



(A)

High-Pass, Notch Filter and Tunable Filter

Date: January 16, 2002
Center Freq: 2400 MHz
Span/Div: 50 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

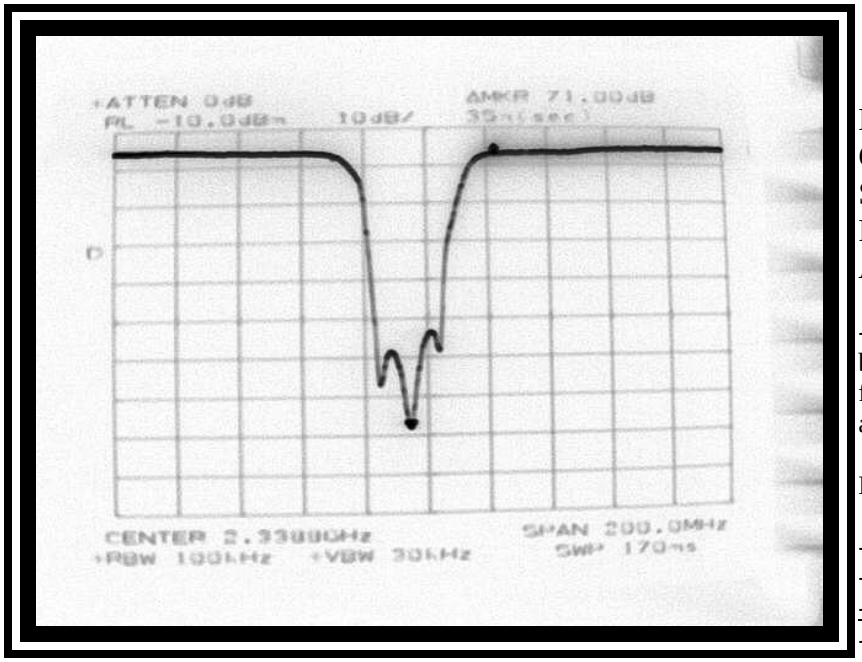
-.67 dBm, 2400 MHz signal indication on the spectrum photograph represents a -60 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

Displayed reference level is equal:

-60 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-107.5 dBW_I; therefore, a displayed signal level of +20 dBm equals an isotropic level of -87 dBW_I.

Reference Level dBW_I

-52.5



(B)

Date: January 16, 2002
Center Freq: 2338 MHz
Span/Div: 200 MHz
Res. Bandwidth: 100 MHz
Amplitude/Div: 10 dB

-10 dBm, signal swept through entire band. Showing 71dB of difference from top signal to maximum attenuation of filters

Displayed reference level is equal:

-10 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-57.5 dBW_I

Figure 2.1-3 RF Calibration Photographs

SECTION

THREE

SECTION 3.1

Reagan National Airport

SECTION 3.1

DATA PRESENTATION

The following section contains the tables, site photos, and spectrum photos pertaining to the site location measured.

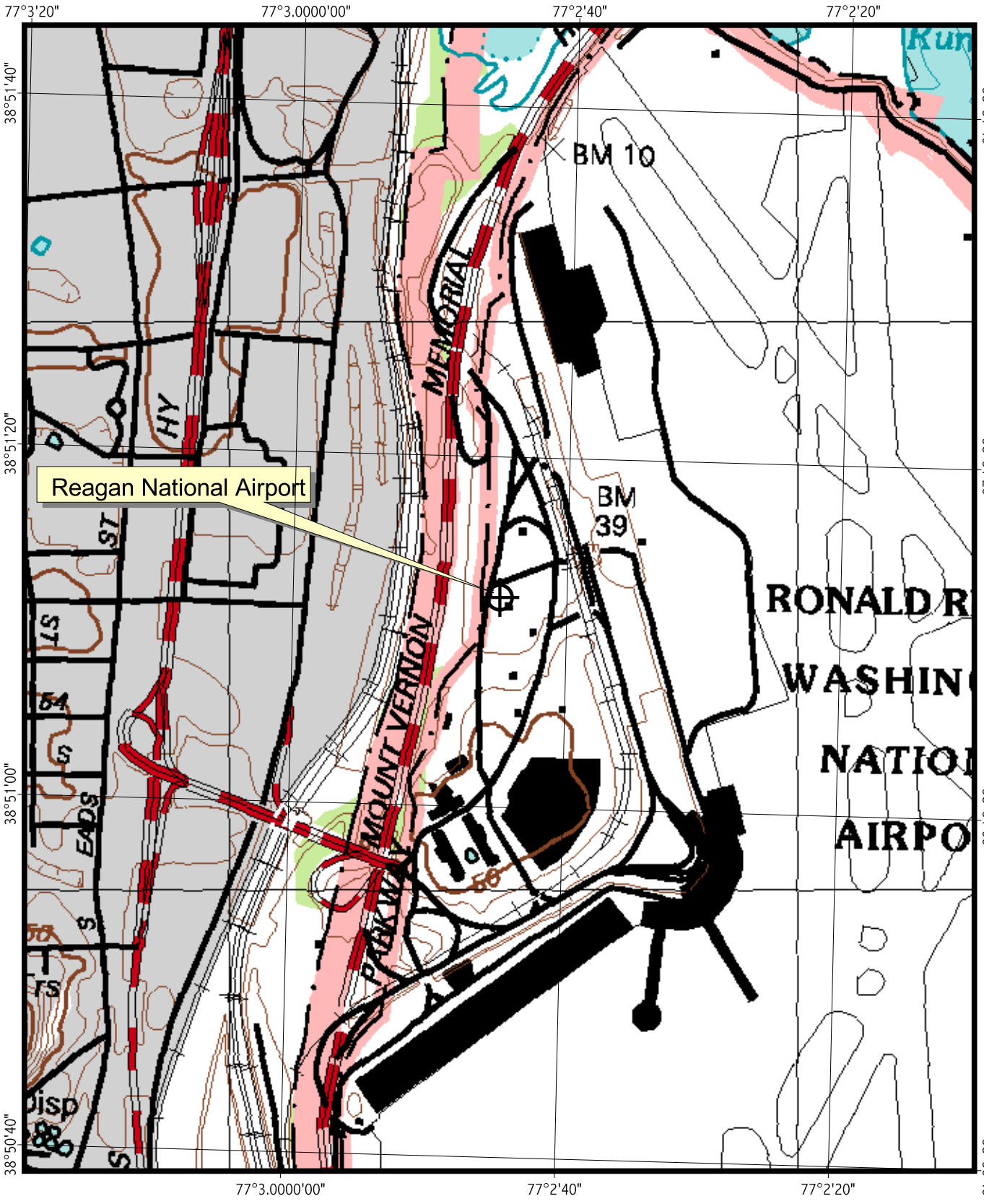
3.1 XM Radio – Reagan National Airport

- Table 3.1-1 presents a site data sheet including all pertinent site information.
- Figure 3.1-1 contains topographic map denoting the test location throughout the measurements.
- Figures 3.1-2 are the photographs depicting the test site.
- Figures 3.1-3 through 3.1-5 are the RF spectrum photographs depicting the interference environment at the test site.

TABLE 3.1-1

MEASUREMENT SITE DATA SHEET

1. SYSTEM NAME:	XM Radio	
2. CITY AND STATE:	Arlington, VA	
3. SITE IDENTIFICATION:	Reagan National Airport	
4. COORDINATES: (NAD 1983)	LATITUDE:	38° 51’ 12.6” N
	LONGITUDE:	77° 02’ 44.8”W
5. SITE TYPE:	Urban	
6. MEASUREMENT DATES & TIMES:	January 16, 2002	1300-1700
	January 18, 2002	1000-1200

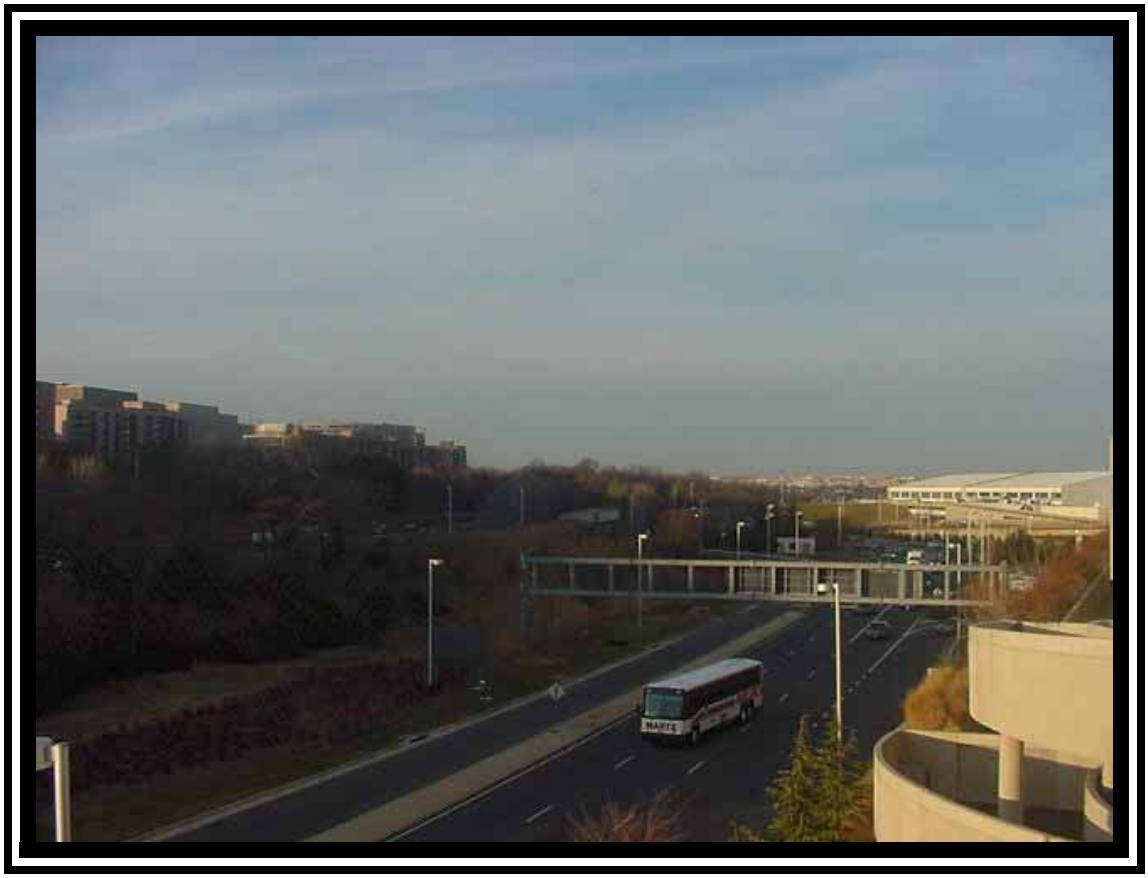


XM RADIO

FIGURE 3.1-1

COMSEARCH

North



East

Figure 3.1-2 Measurement Site Photographs

South

West

Figure 3.1-2 (cont.) Measurement Site Photographs

Az 295°

Az 358° Az 12°

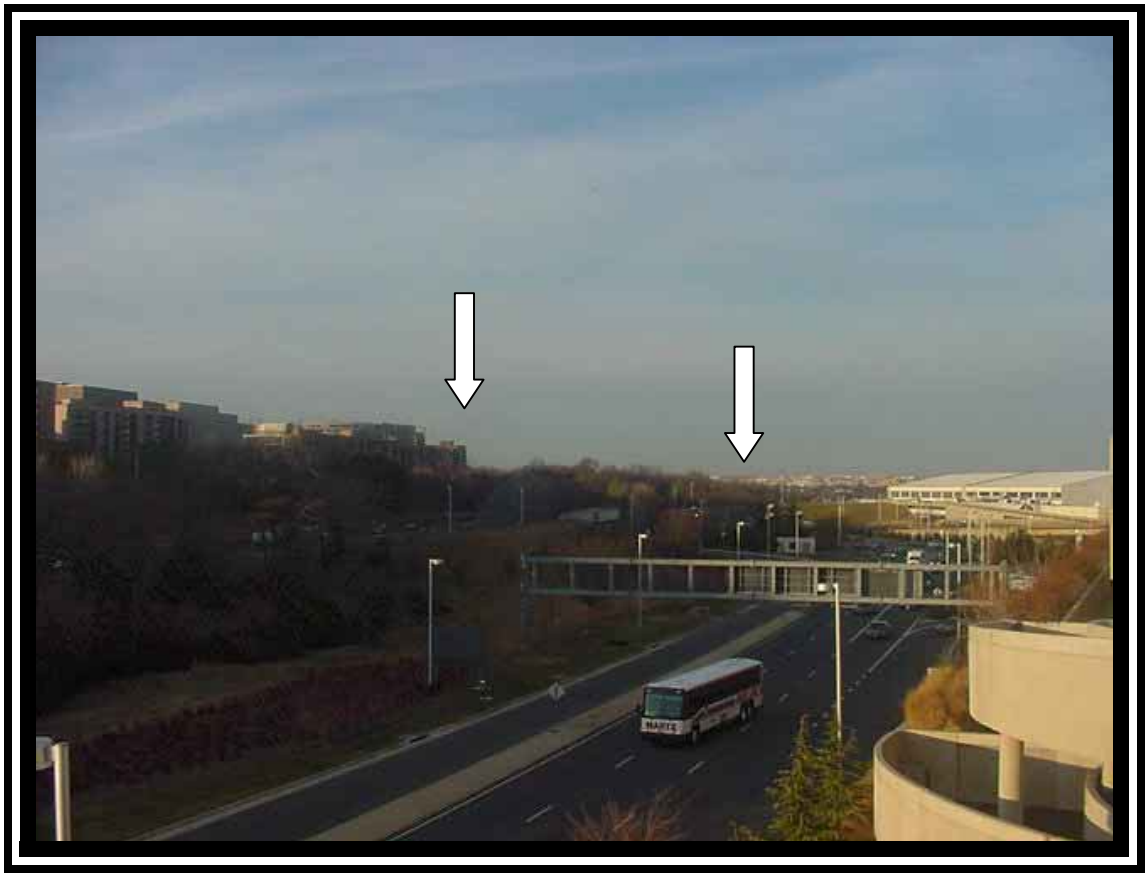


Figure 3.1- 2(cont.) Measurement Site Photographs

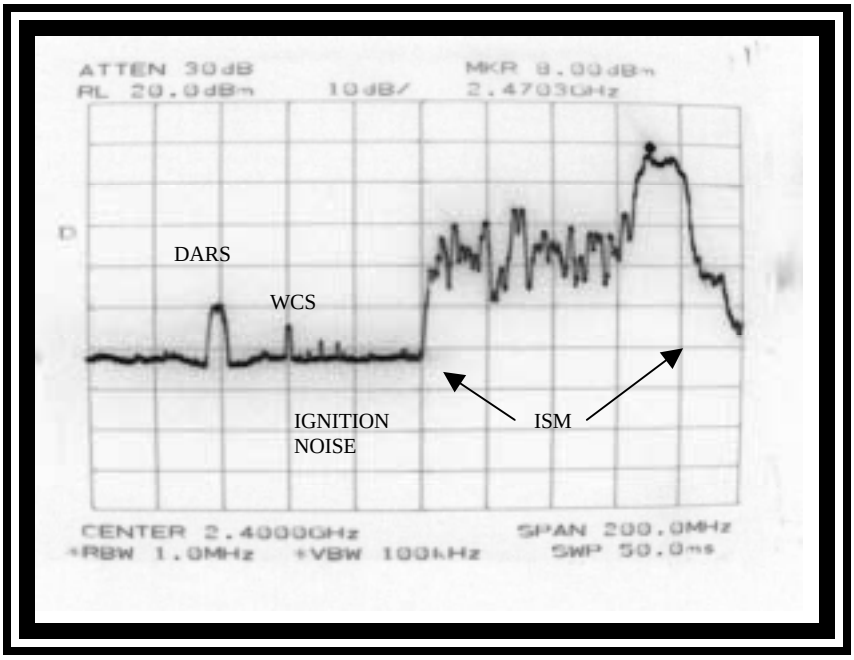
Reagan National Airport

Reference Level dBW_I

Azimuth 0-360°

XM Radio

-87



With High-Pass, Tunable and Notch Filters

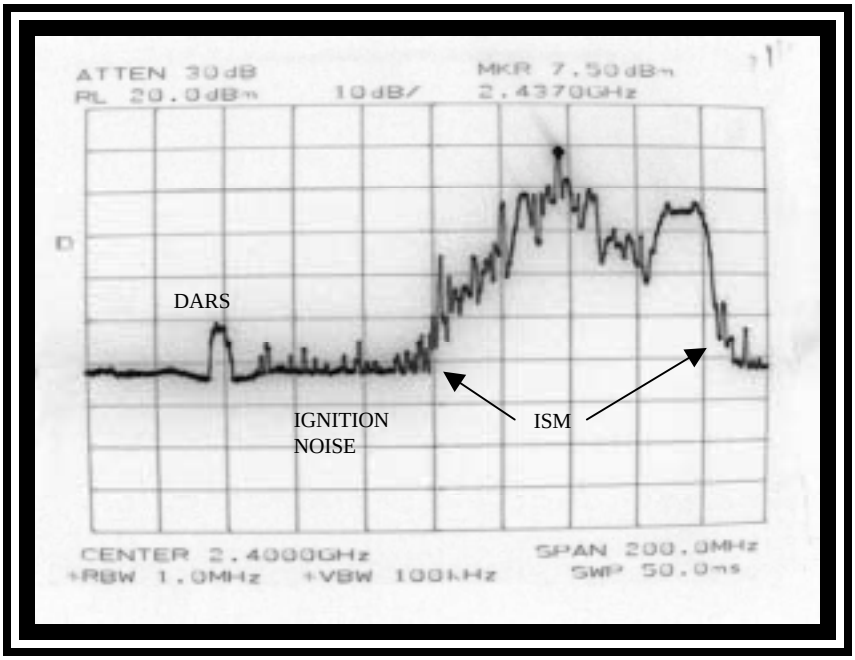
Date: January 18, 2002
Time of Day: 1100
Ant. Polarization: V
Ant. Centerline: 10 Ft.

Full Antenna Sweep

(A)

Reference Level dBW_I

-87



Date: January 18, 2002
Time of Day: 1105
Ant. Polarization: H
Ant. Centerline: 10 Ft.

Full Antenna Sweep

(B)

Figure 3.1-3 RF Spectrum Analysis

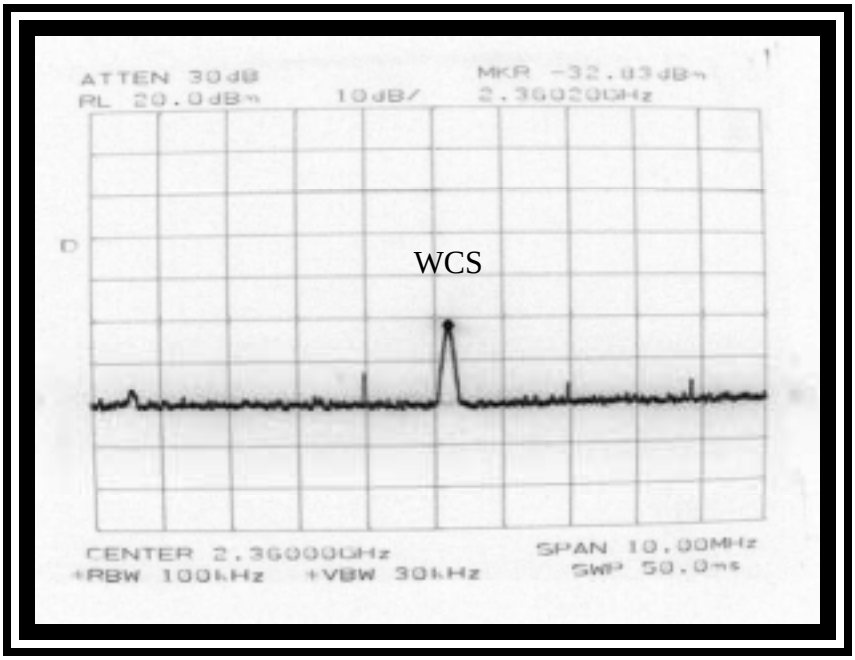
Reagan National Airport

Reference Level dBW_I

Azimuth: 12°

XM Radio

-87



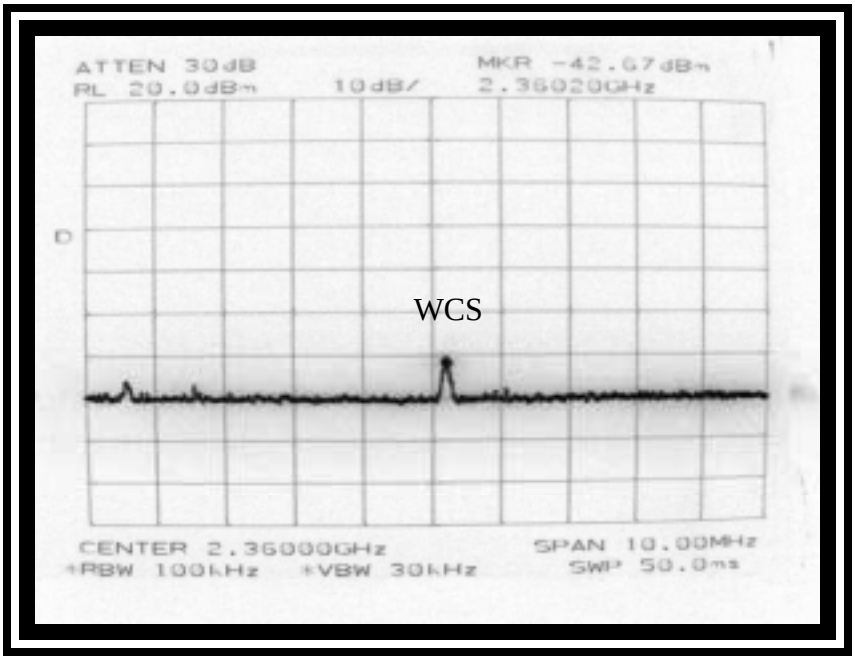
With High-Pass, Tunable and Notch Filters

Date: January 18, 2002
Time of Day: 1125
Ant. Polarization: V
Ant. Centerline: 10 Ft.

(A)

Reference Level dBW_I

-87



Date: January 18, 2002
Time of Day: 1130
Ant. Polarization: H
Ant. Centerline: 10 Ft.

(B)

Figure 3.1-4 RF Spectrum Analysis

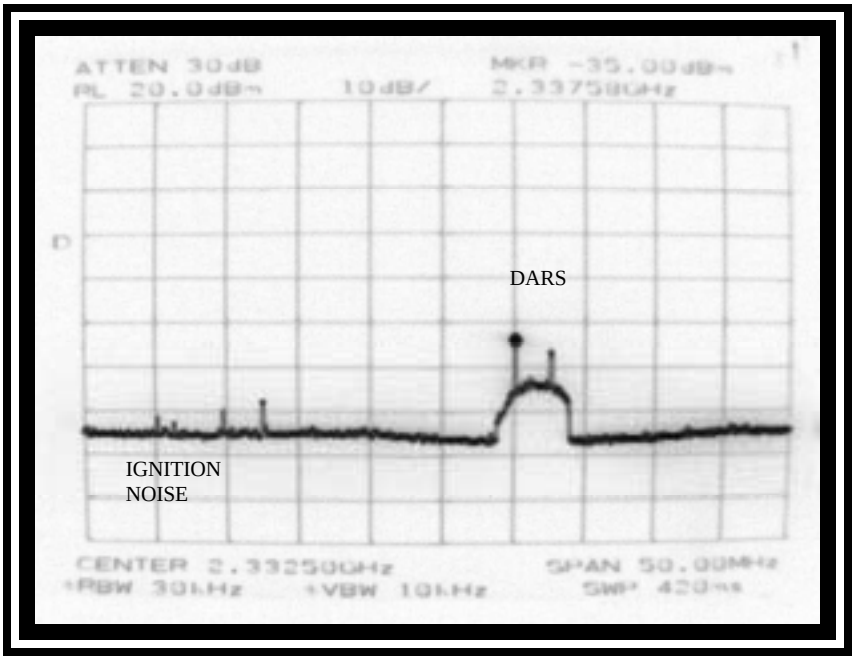
Reagan National Airport

Reference Level dBW_I

Azimuth 358°

XM Radio

-87



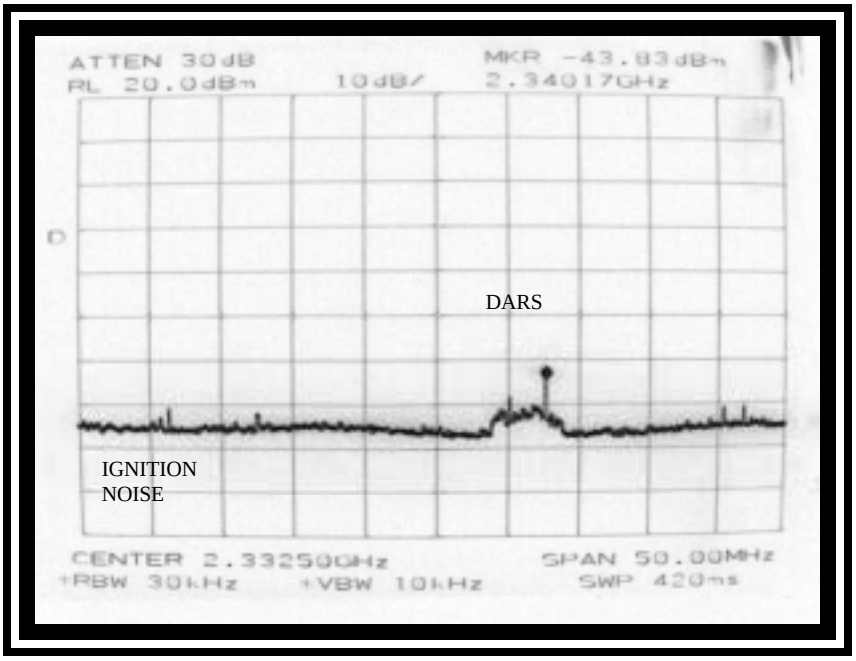
With High-Pass, Tunable and Notch Filters

Date: January 18, 2002
Time of Day: 1140
Ant. Polarization: V
Ant. Centerline: 10 Ft.

(A)

Reference Level dBW_I

-87



Date: January 18, 2002
Time of Day: 1145
Ant. Polarization: H
Ant. Centerline: 10 Ft.

(B)

Figure 3.1-5 RF Spectrum Analysis

SECTION 3.2

Dulles Airport

SECTION 3.2

DATA PRESENTATION

The following section contains the tables, site photos, and spectrum photos pertaining to the site location measured.

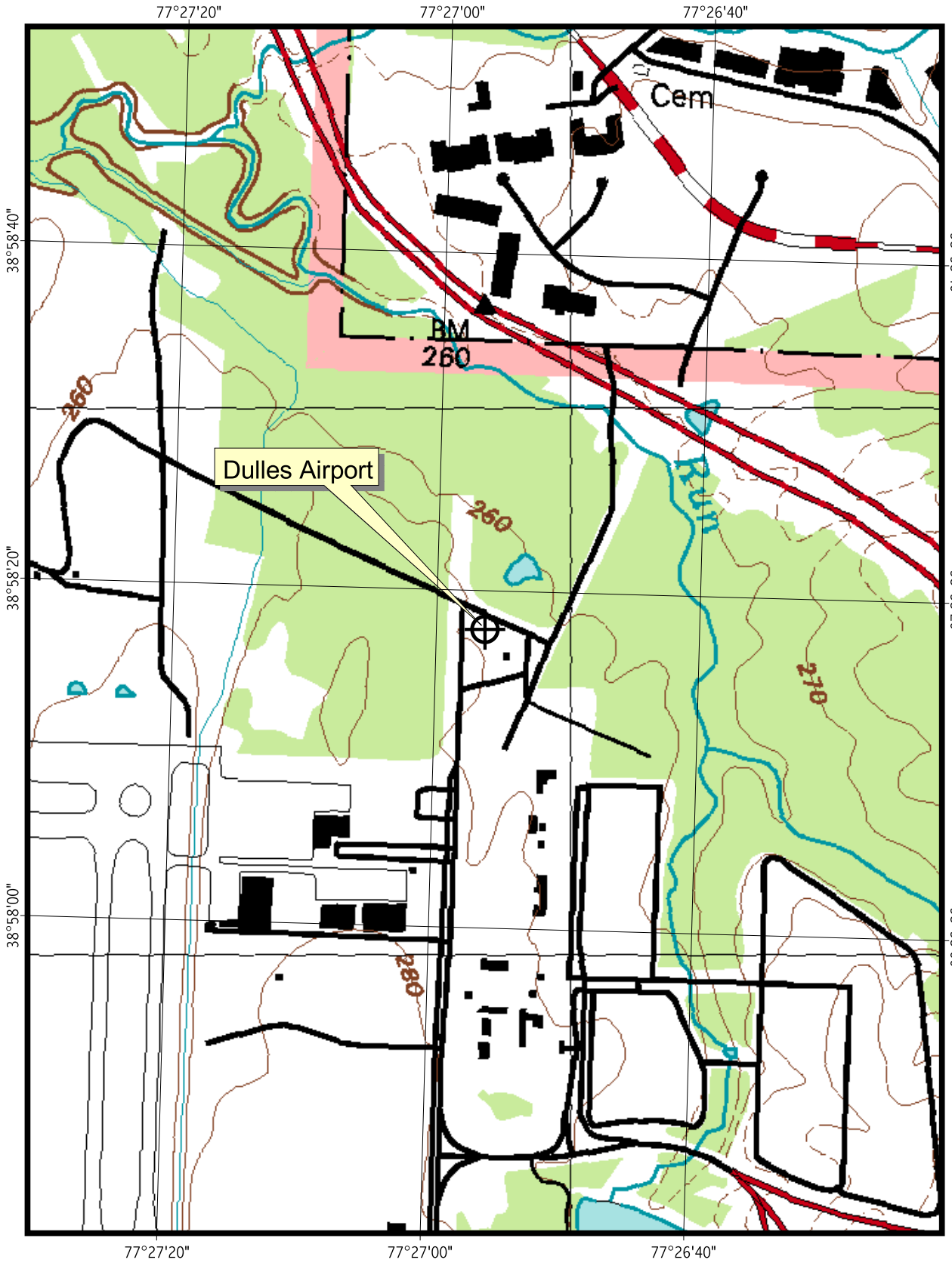
3.2 XM Radio – Dulles Airport

- Table 3.2-1 presents a site data sheet including all pertinent site information.
- Figure 3.2-1 contains topographic map denoting the test location throughout the measurements.
- Figures 3.2-2 are the photographs depicting the test site.
- Figures 3.2-3 through 3.2-4 are the RF spectrum photographs depicting the interference environment at the test site.

TABLE 3.2-1

MEASUREMENT SITE DATA SHEET

1. SYSTEM NAME:	XM Radio	
2. CITY AND STATE:	Dulles, VA	
3. SITE IDENTIFICATION:	Dulles Airport	
4. COORDINATES: (NAD 1983)	LATITUDE:	38^{o} 58’ 21.5” N
	LONGITUDE:	77^{o} 26’ 56.3” W
5. SITE TYPE:	Suburban	
6. MEASUREMENT DATES & TIMES:	January 17, 2002	1400-1500
	January 21, 2002	1230-1330



XM RADIO

FIGURE 3.2-1

COMSEARCH

North

East

Figure 3.2-2 Measurement Site Photographs

South

West

Figure 3.2-2 (cont.) Measurement Site Photographs

Az 128°

Az 189°

Figure 3.2-2 (cont.) Measurement Site Photographs

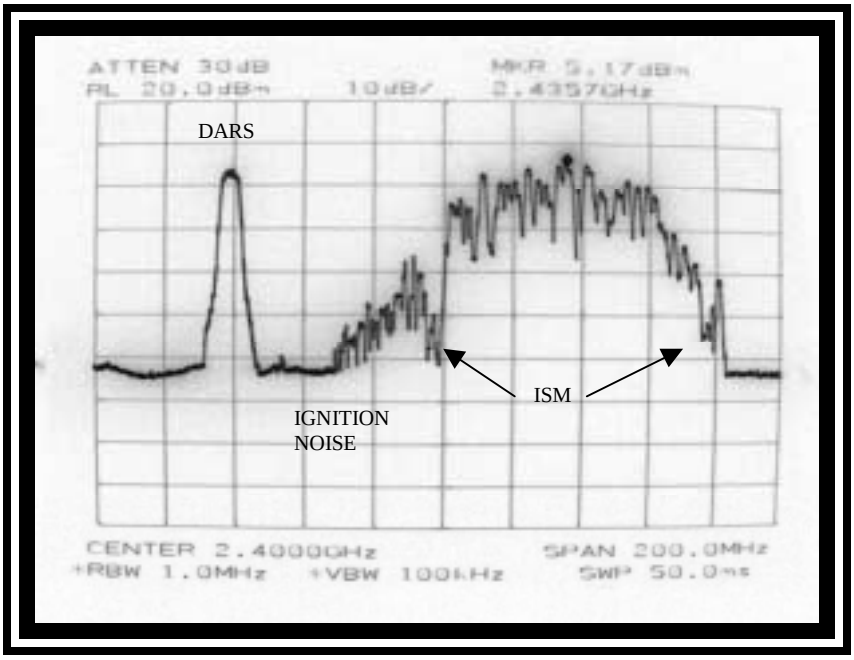
Dulles Airport

Azimuth 189°

XM Radio

Reference Level dBW_I

-89.5



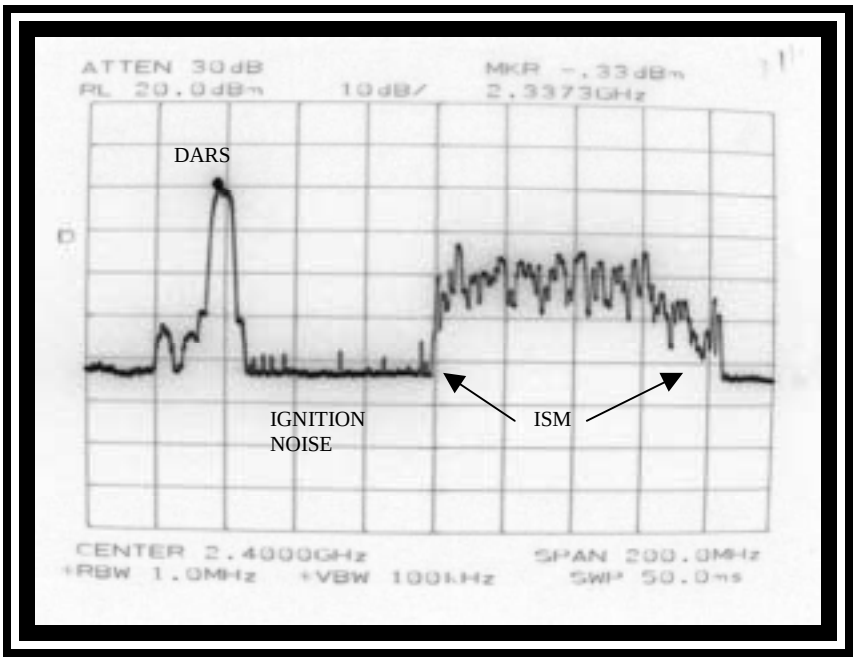
With Tunable and High-Pass Filters

Date: January 17, 2002
Time of Day: 1440
Ant. Polarization: V
Ant. Centerline: 10 Ft.

(A)

Reference Level dBW_I

-89.5



Date: January 17, 2002
Time of Day: 1445
Ant. Polarization: H
Ant. Centerline: 10 Ft.

(B)

Figure 3.2-3 RF Spectrum Analysis

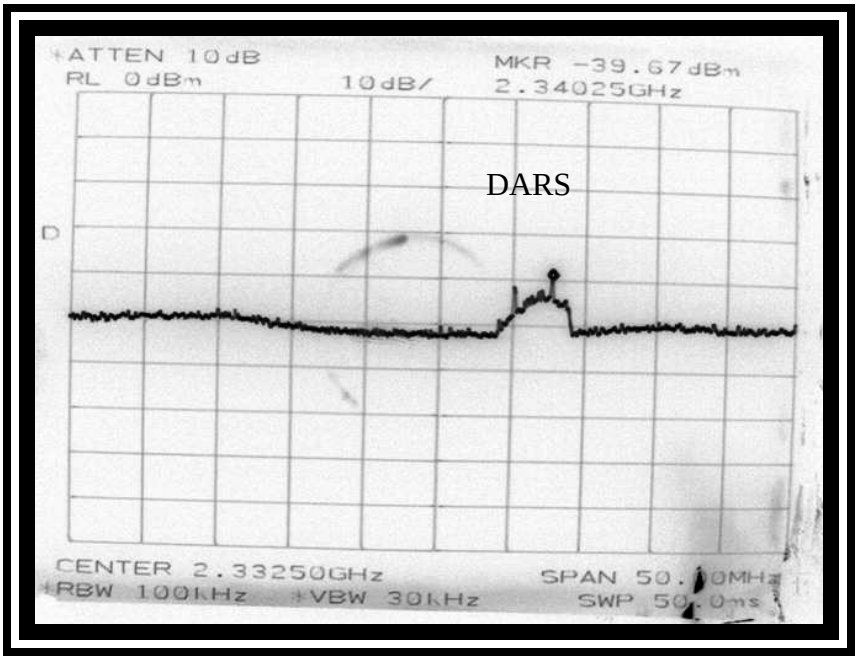
Dulles, Virginia

Reference Level dBW_I

Azimuth 0-360°

XM Radio

-107



With High-Pass, Tunable, and Notch Filters

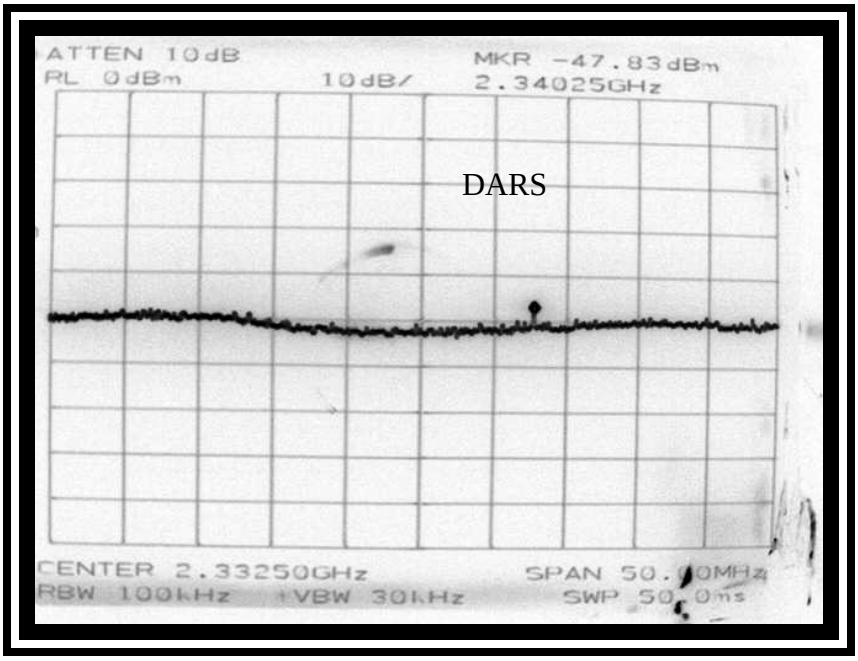
Date: January 21, 2002
Time of Day: 1235
Ant. Polarization: V
Ant. Centerline: 10 Ft.

Full Antenna Sweep

(A)

Reference Level dBW_I

-107



Date: January 21, 2002
Time of Day: 1240
Ant. Polarization: H
Ant. Centerline: 10 Ft.

Full Antenna Sweep

(B)

Figure 3.2-4 RF Spectrum Analysis